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OFFICIAL PUBLICATION OF IOWA STATE COLLEGE OF AGRICULTURE AND MECHANIC ARTS

REPORT OF

PRACTITIONERS' SHORT COURSE IN

VETERINARY MEDICINE

VOL. IV, NO. 1

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I. S. C. of A. & M. A.

Vol. IV. No. 1

DIVISION OF VETERINARY MEDICINE

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INTRODUCTION.

Iowa is becoming an increasingly important state from the standpoint of dairy husbandry. Diseases affecting cattle are usually more pronounced and cause greater damage among dairy animals than the beef breeds. This is obvious because of the purpose for which dairy animals are kept. No one state is in a position to conduct investigations concerning all the diseases which should receive attention. It is our intention therefore to bring experts from other states from time to time in order that the veterinarians of Iowa may receive the benefits of their knowledge along lines which members of our staff have neither time nor opportunity to give especial attention. This bulletin contains much valuable information for Iowa practitioners and I trust they will grasp the opportunity to use it.

C. H. STANGE,
Dean and Director.

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JUDGING AND TYPES OF DAIRY CATTLE.

L. S. Gillett,
Asst. Prof. Animal Husbandry.

I wish to take up a few points regarding the dairy industry and in judging dairy cattle. I believe the purpose of dairy judging ought to be three things.

First, to establish a uniformity of type common to dairy animals. You find at the present time one of the chief objections to a few of our breeds, at least, is the matter of lack of uniformity so far as the type of that breed is concerned.

Second, the purpose of judging ought to be to increase production, to increase the amount of milk and butter fat the cow produces. That is important and it ought to be considered as the second purpose.

Third, to insure the more accurate transmission of dairy qualities. For example, the chief difference between a good milking cow and the dual purpose breed is that the dual purpose cow will not transmit her good qualities as will one of the recognized dairy type.

These three things ought to be considered in the matter of dairy judging. The importance of dairy judging and the dairy industry in this state may be understood more clearly by recognizing something of the extent of the dairy industry here in Iowa. We have about 1,400,000 dairy cows. One of the men in the U. S. Department of Agriculture is said to list as a dairy cow an animal that is suspected of being able at sometime to give milk. You will find that is true, that any cow that gives milk for a shorter or longer time is called a dairy cow. Such a cow averages 130 pounds of butter fat or 3500 pounds of milk. That average production is very low. We have a number of herds in the state which average much more under average conditions.

The record cow, and the record which was made simply last week for a seven-day production in the Holstein breed is 40 pounds of fat in seven days or in other words producing over one-fourth as much as the Iowa cow in a year. That cow is a pure-bred Holstein owned by a breeder in New York state. So you will see that the production of the cows in this state is low, and that is one of the things that lend importance to the selection of better breeding stock because no matter how good feed or attention a farmer may give to the dairy herd, the most important point is the matter of breeding and selecting that individual herd. The matter of dairy breeders is of considerable importance.

According to the state dairy and food Commissioner, the average value of dairy products in this state is about $85,000,000 a year. Of course, that is outside of what is used on the farm, so that the total products would have a valuation of nearly $100,000,000. That does not include the value of the calf nor the value of the manure. It has been variously estimated that the manure ought to be worth $10.00 while the calf will depend upon the breed.

Another thing that affects the dairy industry is in regard to the imports and exports of dairy products. You will find during the last year our exports have increased while our imports have not increaased as much as during past years but have fallen off. So you may see that our exports being increased and our imports being decreased, there ought to be more attention paid to breeding here at home. This is true particularly of Iowa as it is considered a breeding state. It is third in importance so far as dairy cattle is concerned and also from the amount of dairy products. This gives you a general idea of the extent of dairying here.

In judging dairy cows, there is a great deal of difference of opinion. You will note this morning in discussion of the anatomy of the udder, Dr. Murphey said that the point he was discussing was more or less in doubt. When you come down to the matter of judging dairy cows, you find that the same condition is more or less true. The amount of weight which dairy authorities will give to certain qualities varies quite widely. Take, for example, the matter of milk veins. In the experiment, which Dr. Murphey referred to, they took two cows, one a Jersey near the end of her lactation period. They ligated her veins and after the wound had healed, they found the production was within a pint or two of what it was before the operation was performed. She was giving 18 pounds before and came down to 17 pounds. The other animal was a Holstein cow which had tuberculosis and consequently had been condemned and had recently freshened. After the experiment as noted before, they found her production did not decrease any from that before. We may, therefore, draw the conclusion that the importance of milk veins is an exaggeration. Officially ten points are given to the matter of milk veins out of a total of 100 taken from the score card standpoint, but there is considerable variation in regard to the relation that it ought to bear. You may say that the milk veins are of no importance because if they are done away with entirely the cow is able to produce the normal quantity of milk, and normal in appearance also. I suppose that means that the blood which normally supplies the udder was carried up by the pubic vein and the blood which had been supplied

to the udder finally carried back to the heart. Consequently, the milk veins were able to be ligated with little influence on the cow.

However that may be, we find in a high producing cow, a well developed set of milk veins, which lends something to substantiate our belief that the milk veins are indicative of the capacity which a cow will have to produce milk, and especially is that true of milk producing cows. So that while there is more or less difference on a number of these points, it is well to bear in mind, while we do not have anything more definite to tie to, it is best to take things as they are and go ahead to the best of our belief.

In judging dairy cattle, I do not choose to take it up from a score card standpoint, because that is rather elementary, but simply from the standpoint of how we go about in judging cattle.

The first thing is the general appearance when viewed from a distance. I believe in standing off and looking at a cow rather than going up and handling her in judging dairy cows. When you go up and look at the animal, you are close to the animal, but you cannot get as good an idea of the general shape and outline of the cow as you can by standing off a distance. After you have the general impression, you may go ahead and satisfy yourself as to any detail which may not be clear in your mind.

One of the points is I want to see a strong back that does not sag. That is one of the common faults of some of our breeds, being low in the back. Consequently the matter of lines is of considerable importance in judging work.

Then, of course, we should take into consideration the matter of size, whether the cow is large enough for a breeder. That will vary with the breeds. With a Jersey we usually consider 800 pounds as high enough, while with a Holstein cow they may weigh a ton before freshening. The Jerseys are smallest, then Guernseys, the Ayrshires next, while Holsteins are largest.

We do not expect a dairy cow to show as straight an udder line as a beef steer. They are more wedge-shaped, not showing the characteristic line of the beef steer.

Then, of course, in the matter of general appearance you take simply a general view of the head, whether or not it is pleasing. You do not go into detail but simply get a general idea of the make-up of the cow.

One of our leading dairy cattle judges, who happens to be afflicted with the same name I am, says there are just three things you wish to consider in a cow—respiration, circulation and

mammaration. That is if you get the breathing capacity, blood flow and udder capacity, you have the essential points of the dairy cow.

You find that in conformation of head, the breeds vary very widely. The Ayrshire head is medium in type between that of the Jersey and the Holstein. In the first place we like to see an animal with a strong muzzle. It is especially true, of course, that the matter of muzzle is associated with the capacity. The muzzle there ought to be large so as to indicate plenty of capacity in the respiratory organs affording large enough intake as it were, while the muzzle should be large enough to give plenty of strength for chewing the food. Then the length from the muzzle to the forehead varies very widely. In the Jersey you have a short head. The Guernseys approach that closely with the Ayrshire, while the Holsteins are wide as you have noticed. Of course, you expect the Jerseys to show more refinement than the Guernseys.

The Ayrshire has much the largest and crookedest horn of any of our dairy breeds, and it is also the only one in which we pay particular attention to the horn. The horn must be turned up and shaped quite well. It is simply a minor point but one which they have paid a great deal of attention to.

In considering the head also, we want a cow that is free from throatiness. We want a cow that comes out fine and long in the neck. Of course, in a beef steer, we have an animal that we want more compact, but in a dairy cow we want her to show a long neck. We have the neck laid in on the shoulder more smoothly in the Ayrshires than you would have in the Jerseys and Guernseys, although the neck is not so small perhaps as it is in those two breeds.

Coming back over the shoulder, we like to have the spine projecting above so that the withers and shoulders have ample width and room.

One of the things that differentiate the type of dairy cow and a beef steer is the ribs. In a beef steer, you get a rib that comes out round while in the dairy animal you have one which comes down wide at the bottom, showing plenty of depth and more triangular shape.

If a cow does not have the constitution to stand up well for a considerable period of time, she is not going to be as valuable as otherwise. I think the matter of constitution is something we neglect to give as much importance as we should, because not only from the standpoint of the cow having to reproduce for a number of years, but also because she has to resist disease.

You will have much less trouble if the cow has plenty of constitution; in other words, she is not going to give you the trouble she would otherwise when in a weakened condition.

The ribs should be well strung so that you can lay your three fingers in between them, denoting that you have a better digestive capacity.

We like to have a cow come out strong over the loin here and with plenty of room over the hips. You will find a cow that is narrow here will not have room for a calf, and you will also find, of course, that a cow set narrow in this section is apt to have trouble in calving. Also you will not have the attachment for the rear quarter of the udder which you should have.

Also if the thighs are heavy and meaty, you will find the udder projected forward, and that is what you want to take into consideration in judging the dairy bull, that is, if they are full in their thighs, the heifers they get will have their udders pinched together and they cannot develop in the hind quarters. You must take into consideration the leanness and thinness of the thighs as that is transmitted to the offspring, and it is hard enough at best to tell what dairy stock a bull is going to throw. Neither can you tell by looking at a dairy cow just how much milk she is going to give.

Then going on down, we want the cow to be strong enough in her legs to support herself, but usually you find a cow is not deficient in that respect.

Then the constitution is indicated by the size of muzzle, size of nostril and by depth rather than width. Then the matter of capacity is indicated by the muzzle, the size of the middle and the ribs at the bottom showing a good width. Then there is the matter of dairy temperament, sometimes called nervous temperament, and which nobody is able to define exactly. In a conference at Massachusetts, I think, the thing that came up for the most discussion was this subject of dairy temperament. One professor said the matter of dairy temperament was a mistaken idea as it simply cannot be found in a cow. But dairy temperament may mean the temperament as already shown which will indicate that the cow will use her feed for the production of milk instead of production of fat on the tissues. It is shown by having a prominent spine here, by having no fat and not too much meat along the ribs, also the thinness of thighs and by refinement of head. A dairy head differs from the beef head in that it is more refined and not so square as you have in beef animals, so that the matter of dairy temperament is of some importance although it may be hard to see.

One thing you can't tell by looking at a dairy cow, just how much milk she can give. No matter how good a dairy judge a man may be, he cannot go out into a herd and pick out the best cow and the poorest cow. Whenever a man enters a cow judging association, we ask him to pick out the best cow as well as the poorest cow in the herd. Some farmers may be good judges of dairy cows, but so far no one has been able to pick out the best cow and the poorest cow. Some have been able to pick out the highest producer and some the lowest producer, but none of them have been able to pick out the best and the poorest. While the type is more or less closely associated with production, it is impossible for a man to go to a herd and pick out a 300-pound from one that will give 350 pounds of butter fat. When it comes to distinguishing one that gives 150 and one that gives 200, it can't be done with absolute accuracy. The only accurate way to test out a herd is by the Babcock testing scale, by weighing the milk.

In case you select for production alone without giving due emphasis to constitution, you are apt to run down in your herd; consequently in a few generations you may get animals that are deficient in vitality and may not give the production. Therefore, it is essential that you give this matter attention in selection.

Then there is the quality indicated by the pliability of the skin. Some men get the idea that we want a thin skin. A very thin skin is objectionable as is a very thick one. The fineness of hair and fineness of bone or the lack of it, are easily noted.

Finally the point that ought to be given almost primary consideration is the matter of the udder. We find that the most important thing in judging the udder probably is the matter of the quality of the udder. You take for example the udder may be well shaped, may be large so far as absolute size is concerned, but the cow does not milk down. There is too large a percentage of waste material there, too large a percentage of connective tissue or perhaps muscle tissue and too small a percentage of epithelial tissue. When a cow is dry she should have a small udder and pliable, one that will shrink up and be of very small size, while when the cow freshens she should show a large udder well shaped. So far as the shape of the udder is concerned, the most frequent defect in the development is in the forequarters. A large number of cows will show a good rear part, but are deficient in the front udder.

Also you have the matter of teats poorly placed instead of in each quarter of the udder. Another thing is the matter of short teats. They used to say that the short teats of the Ayrshire

cow were due perhaps to that fact that the Ayrshire which came from Scotland had to cross over the heather and the teats had to be short, otherwise she would injure them so in order to survive she had to have short teats, also that women did the milking by stripping with the hand. That theory may be all right, but at the same time it may be of questionable value. In the matter of teats, one of the common faults is a large funnel shaped teat, a teat that is very long and the top part is funnel shaped, and you have an udder that comes down and all develops finally into teats.

In the matter of milk veins, quite often a cow varies a little bit as to how they carry forward and the vein may be either on the right or left side. Furthermore, another point in connection with the veins is that they should be judged by what one breeder is pleased to call a "live vein," that is, a vein when you take it in your fingers, the wall of the vein is not too large and apparently the flow of the blood through it is greater than you would expect for the size of the vein. An "unlive" vein would perhaps be one in which the wall is apparently thick and coarse. You would have a small opening on the inside and the capacity be very small.

We may now say a few words regarding the types of the different breeds. It would be well to bear in mind that each breed has a type very much its own. In the Jerseys, you have the island type, which is prevalent in the show ring and the production type which is more or less distinctly differentiated from the island type. You find the production and the show types of Jerseys have more or less drifted apart.

The same thing is true to a greater or less extent of the Guernseys, although you find that some of the best show animals are also among the best producers. It is entirely possible to have type and production combined.

The Ayrshire is a breed which has potent possibility, which is more or less undeveloped at the present time. It is a breed that has suffered more from lack of advertising than anything else. Apparently it is necessary for a breed of dairy cattle to be popular the same as for a brand of talcum powder or shaving soap. It has to be advertised, and the Ayrshire people have not advertised as successfully as the other breeders. The Guernsey in Iowa is more popular than the Ayrshire owing to the fact that the former has been advertised more than the latter.

You find the Holsteins, of course, are the most widely disseminated breed in the state and a breed that seems to be gaining more rapidly at present than any other breed. The reason for this is that they give a large amount of milk and are very hardy.

The chief objection to Holsteins is their low per cent of butter fat, and if they continue breeding as at the present time on seven-day records without regard to the percentage of fat, they will have considerable trouble with the Holstein breed in that respect.

It is worthy of mention that a seven-day test is of very little value in a milk production cow. In a seven-day test soon after calving when the cow is in a bad state of flesh, the average amount of fat for that cow may be low. The cow which gave this record gave 400 pounds of milk, and it was gotten by getting the cow into a fat condition by judicious feeding, heavy blanketing, etc., which gives a high percentage of fat in that period. These seven-day tests are not good for the average dairyman so far as indicating the average capacity of the year's production. The variation in the seven-day test in relation to the yearly production is so great that it does not afford any indication of the particular dairy qualities of the cow. So I give you that warning in regard to Holsteins, the fact that they are emphasizing points which are of questionable value.

Question: What do you think of the Ayrshire breed in regard to the dairy question?

Prof. Gillett: Personally I like the Ayrshire breed quite well. They milk well, have strong calves and are easy to raise. There are just four dairy breeds that are of very much importance—the Ayrshire, Jersey, Guernsey and Holstein. The Brown Swiss are not of much importance as yet. The Ayrshires do not give as much milk as the Holsteins but more than the Jerseys or Guernseys. The Jerseys produce the richest milk of any breeds, followed by the Guernseys, then the Ayrshires, and the Holsteins are the weakest.

Question: How many pounds of milk do they produce daily?

Prof. Gillett: The average yield I suppose for an Ayrshire herd would be 6000 pounds of milk for ten months or a daily average yield of 20 lbs. a day for a cow. They may run as high as 75 or 80 lbs. The record for the breed is around 27,000 lbs. of milk.

Question: What do you think of the Shorthorn as a dairy cow?

Prof. Gillett: For dairy purposes alone, the Shorthorn ranks below any of the dairy breeds mentioned. The Shorthorn will give a good yield a few months and then dry up. The place for Shorthorns and Red Polls is where you are going to raise baby beef and also use the cows for dairy purposes.

DAIRY FARM SANITATION.

By Cassius Way, D. V. M., 63 Vesey Street, New York City.

In order to insure a healthy herd, we must start with the birth of the calf. Speaking of grade herds, heifers should be selected for raising that are out of the best producing cows in the herd and from purebred sires that are from the best milk producing strains of the breed. Any breed may be selected that best meets the fancy and needs of the dairyman. Too few dairymen appreciate the value of a high class herd bull. The actual money value returned is greater than is usually realized. Suppose the heifer calves from a good sire when they reach maturity produce 500 pounds of milk per year more than the heifers from an inferior sire, and this animal is used in a herd where he is able to produce 30 heifer calves per year for five years, and these animals are allowed to milk in the herd for a period of five years each, then the actual cash return from the offspring of this good sire in milk alone at 4c per quart, to say nothing of his effect on succeeding generations, is $3,000 more than from the offspring of an inferior sire of the same breed.

After the selection of these high grade heifer calves, care should be exercised to insure their health, for upon this point hinges in a large measure their ability to produce at the pail. These calves should be raised under conditions that will tend to protect them from abortion, sterility and its allied diseases, scours, pneumonia, tuberculosis and many other troubles to which the bovine species is heir. It is the general belief among authorities on these subjects that, by taking reasonable precautions during the period between birth and the time heifers come to milk with their first calves, a great deal of the present loss from these diseases may be eliminated. In the case of tuberculosis alone, if we could confine the disease to the present animals infected and protect the future generations from becoming infected, tuberculosis would naturally die out with the present generation of cattle suffering from this disease.

In order to raise heifers that will be good producers, with strong, vigorous constitutions, certain requirements are necessary. It cannot be done in a careless, slipshod, haphazard manner. It has been our experience that calves, to be properly raised, should receive warm whole-milk for a period of three to six weeks. The milk they receive is produced by young cows that have never aborted and that have never reacted to the tuberculin test. Many investigators believe that this is a crucial period regarding the infection of contagious abortion. The milk fed to these calves is drawn from the cow in the most cleanly manner possible; the udder and flanks of the cow are clipped and washed clean before milking, the milk is drawn into a clean sterile pail,

placed in a clean sterile can and fed to the calves from clean sterile feeding pails. At the age of four to six weeks, the calves are gradually weaned to pasteurized skim-milk, which has been heated to a temperature of at least 145 degrees Fahrenheit and held there for at least 30 minutes. This pasteurization is sufficient to kill disease producing organisms and also insures against many dietary troubles and disorders so common in young bovines. In ten days or two weeks, the calves are drinking skim-milk altogether, with such grain as they will eat, and are allowed to feed on timothy when small and later on alfalfa, ensilage and other roughage at will. When skim-milk can be purchased at a reasonable price, it is economical as a calf feed and will produce good results up to the time the calves are one year old.

Our records, while as yet rather incomplete, covering only some 60 or 70 cases, and the results not sufficient to draw very definite conclusions up to the present time, show practically no abortions in first and second calf heifers and the production at the pail is beyond our fondest anticipations. Preventitive measures and careful handling are economical from this standpoint, and it has been our experience that tuberculosis and contagious abortion with its allied diseases can be decreased to a minimum, if not entirely eliminated, in a well regulated herd.

It is much to be regretted that a law is not enacted and enforced in every state providing for efficient pasteurization of skim-milk and whey from public milk plants, cheese and butter factories where these by-products are returned to the farmer for feeding purposes. This is one of the fundamental principles in checking the spread of tuberculosis, contagious abortion together with its allied diseases, and many other infections to the calves and young stock that are to grow to be our future herds. If we could control and eliminate the spreaders of tuberculosis and protect the calves and young stock from infection, the disease would die a natural death with the present generation of cattle that are infected. This one item alone would save our dairy farmers millions of dollars annually, and assist toward the elimination of this possible source of infection to thousands and thousands of children consuming raw dairy products in this country.

These are some of the practical problems in sanitary dairying that largely measure the success obtained. A corps of competent men disseminating this kind of gospel, if they received the proper co-operation and support of the cattle owners, would in a few years be indispensable and most valuable to the dairy industry of this country, to public health officials, to the producer and to the consumer of dairy products. The picture of the benefits

to be obtained is clear, but the funds and the administration are the great questions to be solved. However, I believe that the practical control of tuberculosis and other animal diseases must start with some sane, practical, educational system like this.

While I do not wish at this time to bore the reader with details or lay down any hard and fast rules that should cover a thorough physical examination, suffice it to say that all external appearances of disease should be carefully taken into consideration. The udder and all superficial lymph glands should be critically examined. A careful rectal examination of glands in the pelvis should be made together with as thorough an examination of the genital organs as possible. The lungs should be thoroughly examined by listening to the breathing sounds, and the general appearance of the coat, eyes, ears and the countenance are essential points in this very important work.

It would seem that the future herds might be freed from tuberculosis if the fundamental principles of sanitation and protection in the raising of the calves were carried out. In order to secure a tuberculosis-free herd, higher ideals and better methods than are at present generally in vogue must prevail. It is necessary for the dairyman to raise as much of his own stock as he can; to thoroughly pasteurize all milk that he receives as food and prevent these young cattle from mingling with animals that may be known to be tubercular. He must, to be successful, give these calves a fair chance to grow up to be strong, vigorous, healthy individuals.

When the dairyman has done all these necessary things and has acquired a herd free from tuberculosis that has successfully passed at least two careful tuberculin tests, he should then have some recognition of his work and his accomplishments. An official register of tuberculosis-free herds either by counties or in the state department of agriculture would be of great value to dairymen wishing to buy animals free from this disease, as well as a remuneration to the dairyman who has developed a clean herd.

However, we must remember that the inauguration of a system of protection like this will require years of work and effort, and that the story of sanitation and better living conditions must be told over and over again. The inauguration of such a system as this and getting it into practical operation in less than ten or fifteen years would be nothing less than miraculous. However, the dairymen of today are coming to be better informed on these questions and are more anxious to receive sound, scientific advice than ever before. Our efforts along these lines in co-operation with the cattle owners will be fruitful of many good results.

Proper sanitary surroundings and good living conditions are very important assets in the control of disease and in the development and maintenance of a healthy herd. In our northern latitude a suitable stable for winter quarters is imperative. The stable should be situated in surroundings that afford a good natural drainage and should be equipped with a good cement floor, tight walls and ceiling, ample light (four square feet per cow), plenty of air space (500 cubic feet per animal), and finally, the most essential of all, it should be equipped with an efficient ventilating system. I have studied this matter from a great many viewpoints and have made many observations concerning the proper ventilation of dairy barns, and I am of the opinion that if a sanitary stable can have but one sanitary equipment that one should be ventilation; all others are secondary. Essential as pure wholesome food is to both man and animal, just as essential, and I dare say more so, is pure wholesome air. This great natural agent stands first in the treatment of tuberculosis, and it is equally as important in the prevention of disease and in assisting the body in the various physiological processes of metabolism, assimilation and nutrition. Hippocrates taught twenty-three centuries ago the importance of recognizing natural laws in medicine; he said, "It is to the efforts of nature that the attentive and able physician looks for guidance."

The most modern ideas in regard to proper ventilation of dairy barns are to control the humidity and temperature, and at the same time to provide for constant movement of the air in the stable. The theory of excessive amounts of carbon dioxide or "bad air" being the necessity for ventilation no longer prevails. Animals have been placed in tight experimental boxes and kept confined for weeks without any appreciable change of air, and when the three factors—humidity, temperature and movement of the air—were controlled, the animals made uniform, constant and profitable gains in weight, and were in good spirits and physical condition.

The most practical and efficient means of ventilation is the introduction of plenty of fresh air into the stable and the removal of a corresponding amount, thus controlling the temperature, carrying off the excess moisture and insuring a constant circulation.

In ventilating a cow stable we should provide for fresh air to enter the stable in front of the cows and disseminate without creating draughts throughout the stable, passing out through an outlet of ample size, preferably behind the cows, thus giving the animals the best air in the stable to breathe, and taking out the odor from the feces and urine without carrying it by their

heads. One large outlet shaft of sufficient size to ventilate a stable, being constructed on the ratio of 5 or 6 cows to the square foot, is far more practical, much cheaper and easier to build, and from results obtained is infinitely better than enough small chutes a foot or a foot and a half square to make up the required amount of ventilation area. There should be intakes enough, not exceeding individually one-half a square foot in area, to nearly equal the area of the outtake chute. For example: A stable to accommodate 54 cows would require an outlet shaft 3 feet square containing 9 square feet ventilation area, and 16 or 18 one-half square foot intakes distributed evenly around the outer walls would be required to secure enough fresh air in the stable; these can be regulated to suit the atmospheric conditions, but we must have almost as much inlet area as we have outlet.

The top or cap on the outlet chute should be at least 18 inches above the chute. This is to allow for ample capacity of the large outlet shaft. Many make the mistake of putting the cap on the ventilator, or putting it 6 or 8 inches above the body of the chute, thus cutting down the capacity. When the warm air laden with moisture gets into the chute it cannot get out fast enough, and therefore condenses on the upper portion of the shaft. The large chute is not necessary if the capacity is to be reduced at the top of outlet, the result of which is inefficient and inadequate ventilation. The stable should be tight and the hay chutes closed except when in use. Under these conditions, this ventilation system will work admirably and save the dairyman many dollars in protecting the roof and timbers of his barn from frosting and rotting out.

From the standpoint of the health of the herd, and especially in the control of tuberculosis, we find that radical changes from methods which have been employed in the past are very necessary. In the construction of our most modern and up-to-date stables, we have been very prone to consider the question of economy in labor as a primary factor, forgetting the health of the animal that we are trying so hard to protect. Very expensive, fine, modern stables have been constructed with these labor-saving features mainly in view, which were in reality among the best means for spreading disease. This is brought about by use of the feeding manger which is also used as a watering trough for a large number of animals. In the majority of stables constructed along these lines, the water is turned into the manger, usually at one end, and allowed to flow past the entire row of cows. In cases where there is a "spreader" of the disease, this is an ideal way to transmit infection from one animal to another. The old-fashioned feeding mangers, usually in pairs, which were in use years ago, were from this

standpoint far more economical and sanitary than many of those constructed according to the most modern ideas.

To control this undesirable feature, we have come to regard the individual manger as being very essential. A knowledge of the limitations of the various methods of diagnosing infectious diseases has brought home very clearly to many cattle owners the necessity of erecting barriers in the path of these infectious diseases and taking due precautions in an endeavor to protect the individual members of the herd. From the standpoint of economy in feeding, as well as the control of the spread of infectious diseases, the individual manger fills a long-needed want in modern dairy buildings. Where these are equipped with a proper individual drinking cup or bucket, the chances for the spread of disease along these lines is reduced to a minimum.

I cannot too strongly urge the importance of liberal sunlight in stables, not only for its warmth but for its cheer and assistance in carrying on the daily work during the winter months. When new buildings are to be erected, I would suggest, where possible, that barn run east and west, thus providing for a south exposure, which is so very desirable during the winter. The hovel as a dairy stable is a relic of bygone days. No dairyman can afford to house his cows in an underground, dark, damp or forbidding stable, if he is in the business for profit and satisfactory results. The cow, above all other domesticated animals, responds quickly to the kind of treatment she receives. The limit of her profit is measured by the care and surroundings given her.

A sanitary stable, to be clean and up-to-date these days, must be whitewashed at least two or three times a year, and oftener if necessary. The contrast between the old-time stable, where the spider had hung his drapery of cobwebs from every projection and in every nook and corner, and the modern, clean, whitewashed, convenient stable is very marked. Whitewash is an abomination to the spider and is of great value in dairy sanitation.

Milk should be drawn from the cow at regular intervals into clean pails, preferably of the narrow top design. From a bacteriological standpoint this is the most important stage in the production of clean milk. Excessive numbers of bacter indicate the presence of foreign matter—filth, dirt and age, a high temperature, or a combination of any of the three. Milk that is drawn into an open pail from cows whose udders, flanks and hips are loaded with manure and stable filth, must from the very nature of the process of milking be heavily laden with organisms of an undesirable nature. Therefore, clean cows and narrow top pails are necessary to produce clean milk. Many

experiments have been conducted to ascertain the value of covered pails in reducing the bacterial count with the uniform result that this form of pail reduces the number of bacteria from 40 to 70 per cent. Progressive dairymen are anxious to reduce the undesirable bacterial content of their milk, especially where such an easy and practical solution is at hand, and at the present time the reign of the open milk pail seems doomed.

Next in importance to clean milking is proper cooling; this should be done immediately after the milk is drawn from the cow, inside a clean milk house situated within clean surroundings. The time is past when the dairyman can satisfactorily cool milk without the use of ice. However, in certain sections where there are few lakes and where ice is very hard to obtain, cool well or spring water at a temperature of from 48 to 52 degrees Fahrenheit is essential. Milk can be cooled in a few minutes to within a few degrees of the temperature of this water, and, if the temperature is not allowed to rise above 55 degrees Fahrenheit, the milk can be delivered in good condition. Clean, sanitary milk, therefore, can be obtained if the cows are clean and kept in clean surroundings, and persons caring for them and doing the milking are cleanly in their habits and personal appearance.

Human defilement of milk is probably the most serious form of contamination, for this feature can be constant; while polluted milk from the animal source is of a serious nature also, in many instances it is self-limiting, for the animal, while ill, is very apt to cease the secretion, therefore there is no milk to pollute. But man in his ignorance, indifference or wilfulness can produce a temporary scourge in a community with some form of disease in the vocation of vending the innocent cows' milk. To this end a thorough and systematic medical inspection of dairymen, their families and employes should be maintained by all milk distributors in order to protect their customers and themselves as much as possible. Among the human diseases that are prominent in milk-born epidemics, typhoid fever, scarlet fever, diphtheria and septic sore throat are the most important, and rank in importance in the order mentioned.

Undoubtedly, the Creator intended cows' milk for calves and mothers' milk for babies. However, conditions have so adjusted themselves that the cow has become the foster-mother of four-fifths of the children of this great land. Therefore, it is necessary that, in the production of this delicate and sensitive article of food, certain fundamental principals of cleanliness and sanitation should be observed in the care and handling of this sensitive product.

Veterinary inspection and supervision in relation to dairy and farm sanitation, if of the proper character and intelligence, is surely of great value in the production of pure milk. The inspector must be able to recognize the various abnormal conditions that would tend to make the product unwholesome; he must be a student of pathology; he must recognize cause and effect and be able to apply a remedy. Careful co-operation with the producer, always keeping in mind the health and welfare of the consumer, and the dissemination of sound practical information in an endeavor to assist the dairyman in producing a safer, cleaner, better product, are wonderful factors in raising the standards of production and safeguarding the public health. It is very gratifying to see that the signs of the times point to higher standards of sanitation, and it is hoped that before long these standards will be maintained and enforced by all public health authorities in a manner and on a basis just and equitable for all.

In considering the question of quality, safety and sanitation should rank first. Milk is an almost indispensable article of diet in the modern household, a balanced ration containing enough food to sustain life for an indefinite period. It should contain nothing except that which it has a right to possess by nature—a definite per cent of butterfat, a uniform quantity of other solids, a certain fixed percentage of water, and a few harmless bacteria. The consumer must certainly recognize the value of sanitation in producing this delicate article of food, and he should be willing to meet the dairymen half way in the extra cost of production.

Dairy sanitation in its highest sense means cleanliness, safety and economy. Higher standards are to be in vogue in the future. These must be inaugurated in the health of our herds, in the protection of our young stock and in the conditions under which they live.

"THE BACILLUS ABORTUS AND TESTS FOR THE DETECTION OF ABORTION IN CATTLE."

Chas. Murray & L. E. Willey, Ames, Iowa.

Dr. Murray: I will briefly review the characters of the organism that is the cause of most abortion. The organism is known as the bacillus abortus or Bang's Bacillus, sometimes as Bacterium abortum. The organism was described by Bang in about 1897 and was isolated by him with great difficulty and still is isolated with great difficulty, for several reasons. It has a peculiar oxygen requirement, and is frequently in combination in mixed infection with other organisms. The organism is a small one in size, similar to the Bacillus typhosus, from one to two microns in length and about one-fourth to one-eighth of its

length in thickness. The organism has no peculiarities of appearance in stain or culture except when it has been grown for some time on artificial media. It is one of those organisms known as polymorphic, and when grown in artificial media it acquires involution forms. It has a slight tendency to granular staining. Granules throughout its length may show and particularly at its poles.

The organism possesses no motility. It is non-motile and does not produce any spores in its growth and development; consequently, is not difficult to destroy with heat or disinfectants. It has no protection given it by capsule formation as some organisms have.

The staining is readily accomplished by the use of the ordinary stains, and to the Gram stain it is negative. The isolation of the organism can be made from the heart blood, from the intestines and also from the slime of the placenta and of the uterus. In the latter case its isolation is more difficult because of the mixed infection which is commonly present.

It requires a medium prepared carefully in order to obtain the maximum growth. Ordinary media on which the common bacteria will grow are not suitable for this organism. One of the most favorable media is one used by Bang, known as the gelatin-agar medium, about ¾% agar and 5% gelatin, and equal quantities of this mixture and sterile blood serum.

Its peculiar oxygen relationship is that that in primary culture when first isolated it does not grow well under aerobic conditions nor does it grow well under anaerobic conditions, but it has a requirement that may be met a little below the surface. After the organism has been cultured for a while, however, it can be cultured as the ordinary aerobes.

The temperature at which the growth takes place best is about 37 degrees Centigrade. In its growth on media containing carbohydrates, there is no change produced. Milk is not coagulated. The resistance of the organism to drying has been noted. It will retain its virulence in a locality for a considerable length of time when dried, and in the fetus has been known to retain its vitality for a month. The ordinary disinfectants kill it readily provided it is not protected by mucous secretions.

Dr. Willey: The methods of diagnosis of this disease are mostly confined to agglutination test, complement fixation test, microscopical examination and animal inoculation and precipitation test. Animal inoculation as a method of diagnosis excepting for experimental purposes is unsatisfactory because of the length of time required for the development of the lesions of the disease.

Microscopical examination is not to be relied upon at all times, especially as a method for common laboratory diagnosis, because frequently material which is received at the laboratory for such an examination usually consists of membranes which are very badly contaminated with other organisms, and while it presents some characteristic features in that the organism occurs in pairs and it is Gram-negative and a certain size, yet as a method of positive diagnosis it is not to be relied upon.

The precipitation test is not satisfactory. Also I forgot to mention abortin. Abortin is a product similar to tuberculin prepared in a similar manner, used in larger dosage than tuberculin but it has not proved satisfactory as a diagnostic agent in a large percentage of cases of known infected animals.

The agglutination test is conducted by taking the serum from an animal suspected to be infected with the organism and using various dilutions of this serum with an equal quantity of a bacterial emulsion. The degree of agglutination in these various dilutions is used to determine whether the animal is infected or not.

The complement fixation test is equally as accurate as the agglutination test. It is more difficult to carry out because of the large number of components required to make it. Also each of the components has to be standardized, and as these components decompose quite readily, it does not make a very satisfactory method where a test is made only once in a while.

Now these serological tests for the detection of abortion disease in cattle are not 100% perfect. A negative reaction in a single animal where abortions occur, does not eliminate the possibility of that animal harboring the organism. An aborting cow may give a positive reaction to any one of the serological tests. But a positive reaction does not indicate that the animal giving such a test will abort or has aborted. You cannot rely on the test to indicate the stage of the infection. The development of specific antibodies may have been acquired without the occurrence of any visible manifestations, that is, an animal may become immune without necessarily having aborted. Therefore, these tests as diagnostic agencies in individual cases cannot be relied upon as absolutely accurate. They are valuable agencies in indicating the presence of the disease in a herd, in experimental work, and in arriving at a correct diagnosis.

McFadyean and Stockman in their report in one group of 535 presumably healthy cattle consisting of bulls, steers, non-pregnant heifers and young calves, found that out of 526 of these, the serum when tested with dilutions containing not less than 1-50 failed to cause any distinct agglutination. In other words

in this group, the accuracy of the test is 98%+. McFadyean and Stockman claim that as a rule a positive test may be obtained from 7 to 21 days after the infection of the animal.

CONTAGIOUS ABORTION—ITS COMPLICATIONS AND THEIR TREATMENT.

H. E. Bemis, Ames, Iowa.

Contagious abortion and its complications is without doubt one of the most important if not the most important disease of breeding and dairy cattle today and is occupying the attention of many of our most noted investigators on both sides of the Atlantic. The cause of the disease was discovered by Bang just twenty years ago but comparatively recent investigations have contributed much to our understanding of the disease.

The infection may gain entrance thru the alimentary canal even before birth, or thru the circulation, or the genital canal. Its favtorite location seems to be in the uterus and, according to the recent reports of Schroeder & Cotton, in the udder where it may persist for years after the abortion.

Dr. W. L. Williams claims that the disease is chronic, that abortion is only one symptom of the disease and that therefore the condition has been wrongly named. He further states that the four leading symptoms are abortion, premature birth, retained placenta, and sterility and that granular venereal disease has a vital relation to contagious abortion.

White scours and pneumonia in calves are common in herds in which abortion exists.

Our observations among breeding herds of Iowa have borne out the statements just made. The losses in the old established herds that are affected with contagious abortion are due to abortion occasionally, but for the most part are due to retained placenta, pyometra, endometritis, death and mumification of fetus and cystic and fibrous ovaries followed by sterility. Among the herds which have been free from infection but which become suddenly infected thru the introduction of infected animals, then the disease takes the form of an acute outbreak resulting in the loss of a large per cent of the calves during the first year, after which the abortions become fewer altho retained placenta, metritis and sterility remain. Can it be said that the herd which shows few abortions or none, but does show these other symptoms, is free from the disease? I am firmly of the opinion that the tendency on the part of owners and some veterinarians to look only for a number of abortions to indicate the presence of contagious abortion is one of the greatest dangers to the cattle breeding industry. It has lead, for instance, to the faith in carbolic acid,

methylene blue, abortion bacterins and various other products as being agents capable of preventing or controlling the disease. The work of McFaydean and Stockman, and Eichorn seem to indicate that the best results in immunizing cows may be expected from the use of enormous doses of living organisms injected intravenously in heifers before their first conception. 50 cc of culture in single injection, 40,000 two months before breeding.

The complications which are most common among cows are abortion, retained placenta, endometritis, pyometra, mumification of the fetus, salpingitis, and cystic or fibrous ovaries. Retained placenta is supposedly due to the inflammation which exists in the walls of the uterus and results in adhesions of the fetal to the maternal placenta. The membranes in these cases are usually thin and easily torn and the uterus contains an abundant thin brownish discharge. The handling of retained placenta has been the subject of much discussion. I am of the opinion that the membranes should be taken away as soon as they can be taken without tearing. The papillae of the fetal placenta should be dislodged completely from the crypts of the maternal placenta by most careful manipulation. If the membranes are torn away leaving even the papillea in place, dead tissue which can not be removed is left in the depths of the walls of a wounded uterus and acute metritis is very apt to result. After the removal of the membrane the uterus should be irrigated with a mild antiseptic such as Therapogen 1%, and the fluid completely removed or the uterus even wiped out with gauze or a clean towel.

If there is evidence of metritis, two drams of iodoform and two drams of boric acid in capsule should be placed in the uterus, or the uterus irrigated once a week with 2% Lugol's solution followed by normal salt solution. The Lugol's solution should not be allowed to come in contact with the mucous membrane of the vagina. Such treatment should be continued until discharges cease when the animal may be rebred, after the uterus becomes normal. We believe that the greatest service can be rendered by the veterinarian in this, the first and most constant complication of abortion infection. The proper treatment of this condition should not only make subsequent abortions and retained placenta less liable but should prevent many cases of chronic metritis, pyometra and diseased ovaries which are much less hopeful in their treatment. Acute metritis should be treated early.

Chronic metritis should be diagnosed by rectal palpation of the uterus which will be found enlarged, thick walled and "boggy" and usually accompanied by enlargement of the ovaries due to cystic degeneration of the corpora lutea. In many cases the ex-

ternal os is hypertrophied, overhanging; the cervix somewhat enlarged and open, and emitting a muco-purulent discharge. The treatment of this condition depends upon the direct application of disinfectants to the walls of the diseased uterus. This will necessitate a set of uterine forceps and irrigators. The cervix is grasped with forceps and drawn back between the lips of the vulva where it is held while a dilator can be placed into the uterus and then opened to dilate the cervix for the passage of the tubes. If the uterus is only slightly infected, irrigation once a week with a mild antiseptic may suffice. In case of deep seated and long standing infection, the uterus should be irrigated with a 2% Lugol's solution once or twice a week or one to two drams of pure phenol injected directly into the uterus followed by alcohol and then the whole irrigated out with normal salt solution. The phenol must not come in contact with the vagina. This treatment should always be supplemented by massage of the uterus and ovaries per rectum and pressing out cysts or hypertrophied bodies. During such treatment, breeding should cease until the uterus has become small and pliable so that the whole organ can be gathered up in the hand in the pelvic cavity. Some cases which have been sterile for two or three years will return to service but the prognosis on the whole is not favorable.

Pyometra refers to a collection of pus in the cavity of the uterus. It can be diagnosed by rectal palpation. The walls of the uterus are thin, but stretched out and weighed down into the abdominal cavity by the fluid. There may be an intermittant discharge of foul pus especially when the animal is lying down. Heat is almost invariably absent but the animal otherwise is in good condition. Treatment consists again in dilation of the cervix and the thoro irrigation of the uterus always draining it thoroly by the use of the tube and rectal manipulation. This process must be kept up once or twice a week for several weeks and is indicated only in valuable breeding animals.

Many times the operator finds granular vaginitis in all stages of severity from a few granular elevations in the lower commissure of the vulva to an extreme inflammation of the entire vagina. These cases are usually accompanied by enlarged and cystic ovaries which result in various phenomena regarding heat. Sometimes the heat is regular and normal. Sometimes excessive during estrum but with normal intervals, sometimes irregular intervals either too short or too long. The treatment of these cases is carried out about as before except that the uterus does not need treatment. Granular vaginitis seems to yield to irrigations with ½% Lugol's or 1% Therapogen or the two used alternately. The cysts in the ovaries recur every week to 10 days and should be expelled each time until they no longer

occur. Sometimes this process requires months of treatment and it may be impossible or impracticable to carry it out to completion. In our experience the cases which have given the best results are those in which the vaginitis is slight, the uterus, not involved, and the ovarian cysts soft and thin walled. Such cases usually show nymphomania and it has been noticed that the symptoms of nymphomania subside immediately upon crushing the cysts. When the cysts no longer form and the animal passes over one normal period of heat she is ready again for service and usually conceives.

In conclusion we should expect the following complications in abortion disease:

1. Abortion and premature birth for which there is at present no prevention after infection takes place altho all affected animals do not abort.
2. Retained placenta which should be removed as soon as possible without tearing; and the uterus irrigated as long as there is discharge.
3. Metritis, acute or chronic resulting in sterility. Treatment long continued and prognosis none too good. The greatest hope is in the proper treatment of acute metritis and retained placenta.
4. Cystic and fibrous ovaries.
5. Granular venereal disease.

Mention has not been made in this paper of mastitis or the diseases of the new born which are often due to the abortion bacillus.

MORNING SESSION, FRIDAY, JANUARY 12th, 1917.

Dr. Bemis: Dr. Cotton is a graduate of the University of Pennsylvania and he is one of the best known practitioners in the entire country. He is at the present time president of the American Veterinary Medical Association. He is a good fellow and will give us an excellent talk, I am sure. I am sorry we are late, but he took a lot of time this morning to comb his hair so we are delayed.

Dr. Cotton: Mr. Chairman and gentlemen: I am afraid that you are going to be disappointed. He has extolled me so highly that I am sure I cannot carry out the impression that he undertook to leave with you of my wonderful ability and so on. The subject I have been asked to read a paper on this morning is one on which I am not going to undertake to offer you any new theories. That is all we have been getting fired at us for the last four or five years, and particularly the last four or five

months. Each investigator looks at it from a different standpoint and draws a different conclusion, and we as practitioners, perhaps we copyists, all that we can do is to undertake to draw the best conclusions from a practical standpoint that we can.

Particularly in the last six months have we had theories thrown at us that are certainly confusing, but I do think that we can and should at this time undertake to do something in the way of control and particularly something in the way of helping the breeder and the dairyman in taking care of his sterile animals and trying to prevent the losses of his calves.

Last week we had a meeting of the state breeders association in Minnesota, at which Dr. Williams talked to the breeders two days in succession, and I told our Minnesota state society last night, and I want to repeat it now, that I am satisfied that the intelligent breeder today knows more about this question than the average veterinary practitioner. Now gentlemen, that is a fact. I am ashamed to say it, and nobody is to blame but the practitioner. Dr. Williams talked to these breeders and advised them what was necessary to do, particularly talking from the standpoint of sterility. Some of them asked questions as to whether they could not do this flushing of the uterus. He said, "No sir, it is absolutely dangerous—you must have a qualified veterinarian to do this work." Then they asked, "Where can we get them? Who is experienced in this work? We have only four men in our state that have undertaken to do any of this."

It is certainly a work we must get into, or we will be open to a great deal more consure than we are getting now.

ABORTION FROM THE PRACTITIONERS STANDPOINT.

Charles E. Cotton, V. M. D., Minneapolis, Minn.

I have no new theories to advance on this disease, so called "contagious abortion," but will undertake to give a review of the subject from a practitioner's standpoint.

For the past twenty years the practitioner's position with his clients or owners of valuable herds in which contagious abortion has occurred, has been very unsatisfactory. The conflicting theories advanced by our laboratory investigators and experimentors have been confusing. The treatments by vaccines, bacterines, the carbolic acid treatment, the methylene blue treatment have all failed in our hands. Our knowledge of the disease has been so limited that the efforts of the busy practitioner to control or combat the disease in herds have not been satisfactory.

I am of the opinion, in the light of our present knowledge, that we can and should do more at least in the line of prevention by sanitation.

Abortion is very wide spread and is increasing rapidly in its ravages. Up to a short time ago it was most prevalent in our dairy and breeding cattle. It has now extended to cattle on our western and southern ranges, where it has become a serious economic problem for our beef industry. Some ranges report losses of fifty per cent of their calves.

The disease has been known to be infectious for a number of years but the organism which is responsible for this scourge was not discovered until 1896 when Prof. Bang, of Denmark, succeeded in proving that it was a small bacillus which he claims produces a catarrhal inflammation in the pregnant uterus. We do not know whether the abortion bacillus primarily causes a disease of pregnant uterus which leads to abortion, or whether it primarily causes a disease of the foetus which later extends to the uterus, causing it to expel its contents.

Investigations by McFadyean and Stockman, Schroeder and Cotton, Moore and Williams, led to the discovery that infection could and did take place through the alimentary canal by ingestion of milk in young animals and by the ingestion of contaminated foods in older animals.

Authorities differ as to the source of the bacillus in milk. Schroeder, Cotton and Mohler's work concludes that the bacillus enters the udder from the blood, while Williams claims that it enters through the canal from contamination by discharges from the diseased uterus and genital canal. Investigators agree that they find the abortion bacillus in milk for years after the abortion.

The bacillus of abortion is found in the foetus, in the placenta and the uterine discharges of animals after abortion and animals that have aborted once may still carry the bacillus in the placenta at the time of the third successive normal parturition or four years after the last abortion occurred. Thus, although they are not aborters, they are still carriers and disseminators of the infection. It is also a very important fact that cows which have never aborted and give birth regularly and normally to healthy calves may be chronic carriers and disseminators of the infection.

Schroeder and Cotton in recent reports of their work state that "the udder is seemingly the only habitat of the abortion bacillus in the bodies of non-pregnant cows." They found that "abortion bacilli injected into the veins of normal, non-pregnant cows disappeared from their circulating blood in the course of

a few hours and when such cows were killed some time afterwards, though their blood had become positive with agglutination tests, the germs could not be found in their bodies unless it was in their udders and associated lymph glands." "The occurrence of the bacilli in the supramammary, and in one instance in the pelvic lymph glands, and no further into the body, merely proves that the germs tend to penetrate into the body from the udder through the lymph channels, but they cannot go very far before they are destroyed. Abortion bacilli injected into the udder through the teat will infect the udder and the cow and produce abortion, retained after birth or metritis. In other words the udder is a possible channel through which abortion bacilli may penetrate into the body.

Schroeder and Cotton state that in all cases in which they found abortion bacilli in the uterus after seemingly normal parturitions, it was in cows with infected udders, and in practically half of the cows with infected udders they found the uterus and placenta infected with abortion bacilli. They state that, "the uteruses of non-pregnant cows, irrespective of whether their udders were infected or not, never revealed the presence of abortion bacilli." All their work conclusively proves that the bacillus does not live in the non-gravid uterus and that the discharge from the uterus of a cow which has aborted may contain the bacilli for twenty to fifty days, but they eventually disappear. They believe that the "abundance and period of the persistence of the bacilli is intimately related to the magnitude of the lesions in the uterus attendant upon an abortion."[1]

There is a difference of opinion as to the infection being transmitted by copulation. Most are agreed that the bull is the passive or mechanical carrier, especially where several breeders use the same animal or he is allowed to serve both healthy and infected animals. But whether a bull with systemic infection is capable of injecting the organism with the seminal fluid remains to be determined. McFadyean and Stockman, after some experiments, conclude that the bull has no part in the dissemination of contagious abortion, or, if he has a part, it is merely that of a passive carrier.

Cotton could not demonstrate the presence of abortion bacilli in the reproductive organs of a bull that had been used to serve aborting cows, or in the testicles of two bull calves, one of which had been fed and the other injected with culture of the abortion bacillus. He states that the bull does not harbor the organisms in the testicles. Schroeder states that he has found that bulls which are regularly exposed to abortion infected cows rarely react with the agglutination test, notwithstanding that bulls which have received inoculation of abor-

tion bacilli invariably react with this test. He says that the abortion bacilli rarely get into the bodies of male cattle in a way to cause modifications which can be determined by any means at our command. He adds, however, that bulls may play a very important part in the transmission of these organisms from cow to cow.

McFaydean, Sheather and Minett have shown that it is possible to inoculate a bull by introducing cultures of the abortion organisms into the prepuce.

Williams claims that even though a bull reacts to the agglutination and complement fixation tests, we have no evidence to show that the infection is ever eliminated from the animal's body.

Hadley and Lothe carried out a number of experiments with a few bulls on a small scale and conclude there is no question but that a bull may acquire a systemic infection by experimental inoculation and by copulation with a cow that harbors abortion bacilli in her uterine and vaginal secretions. Whether or not such an infected bull is capable of disseminating the infection by cohabitation remains to be conclusively proved. However, the soiled bulls with systemic infections used in this experiment did not transmit the abortion disease to the virgin, abortion-free heifers with which they were mated. They showed that certain bulls are less susceptible to and possess a greater natural immunity against abortion infection than do heifers and cows. In some cases this is apparently a sexual immunity. In other cases it seems to be an individual immunity.

Whatever the reasons are, it is certain that something operates to exert a detrimental action on the abortion bacilli that gain entrance to the bodies of bulls which so attenuates them that they are incapable of setting up immediate infection in susceptible heifers. This theory is supported by the fact that the serum reactions given by systematically infected bulls gradually become weaker until they finally disappear entirely.

They also tentatively conclude that a bull acting simply as a mechanical or passive carrier of infection, gained as a result of serving infected cows, cannot transmit the infection to susceptible cows which he may subsequently serve, if a period of a few weeks is allowed to elapse between the services.

All authorities agree that infected pregnant cows introduced into healthy herds are responsible for the introduction of the disease when they abort. Bacteriological examination of vaginal scrapings have proven the bacillus is eliminated through this channel for a period of twenty to fifty days after abortion. This is probably one of the principal sources of the disease in

a non-infected herd, but it is impossible to determine by any clinical examination whether or not a cow be infected with the germ of abortion.

Dr. Williams believes that calves born in infected herds from diseased mothers become contaminated not only in utero but from nursing the diseased mothers.

The disease has been produced artificially by feeding infected material, by injecting pure cultures of the bicillus abortus intravenously, by placing pieces of the placenta of aborting animals into the vagina of pregnant cows and also by injecting cultures of the bacillus into the udder through the teats. Investigators disagree as to the channels of infection. McFadyean and Stockman, and Mohler believe that the infection enters the digestive tract by contaminated food and passes through the blood to the uterus and there produces pathological lesions which cause the abortion. Drs. Bang and Williams believe that the organism enters the uterus through the cervical canal not later than the date of conception and after the cervix has been sealed and the infection has not gained entrance the animal will not abort. Williams believes, "most animals become infected at a much earlier date and the infection is lying in wait in the uterine cavity at the time of the first copulation or exists elsewhere in the system in a more or less latent state, while, as I stated before, Schroeder and Cotton claim that the infection cannot live in a non-pregnant uterus but does exist in the udder and its lymph glands and when animal becomes pregnant will then infect the uterus and its membranes.

Drs. Hadley and Lothe state that the methods by which the infection may be transferred from one animal to another are first, by contaminated food and water; second, by licking of infected cows; and third, by smearing of infectious material upon the vulva.

Symptoms.

Williams claims that the act of abortion is only one symptom of this chronic contagious disease of the generative organs of cattle and that the disease is improperly named. He states that the disease manifests itself by the four leading symptoms: viz., abortion, premature birth, retained afterbirth and sterility. He also states that "granular venereal disease is universally distributed and it has, by clinical observation a vital relation to contagious abortion." In herds in which contagious abortion exists, white scours and pneumonia in the newborn calves are very common. Both of these infections have a close association with contagious abortion. The investigations of Schroeder and Cotton and others show that the calves are exposed to the bacillus of abortion through the ingestion of raw

milk. In the foetus from cows which have aborted, pure cultures of the bacillus abortus are found. Williams believes that calves born from diseased mothers have the infection in their alimentary tract from having swallowed the amniotic fluid while in utero. He states, "granular venereal disease appears in the genital sheaths of calves at 30 to 50 days of age, when fed upon raw milk, and the prepucial hairs concurrently become stained brown or black and matted together with muco pus. The blood of these calves largely reacts to the serologic tests from the 20th to the 60th day, receding for a time when the calf is placed largely upon herbaceous food, but will react again about the time of the first ostrum." He says, "calves grown exclusively upon boiled milk generally retain clean sexual and prepucial hairs, do not develop granular venereal disease markedly, and their blood fails to respond to the serological tests for contagious abortion."

Drs. Giltner, Cooledge and Huddleson, in a paper read before the American Veterinary Medical Association last fall, in which they presented the results of their experiments of milk from cows infected with contagious abortion, conclude "that there is no connection whatever, between the feeding of infected or non-infected milk and the matting and staining of the sexual hairs of new born calves."

*Dr. Williams has statistics of a very large herd of cattle, in which for a period of fifty months 44.1 per cent had aborted, and for a period of forty months after they had been fed on boiled milk the abortion decreased to 9.8 per cent. During all of this period new, susceptible animals were constantly added to the herd.

The premonitory symptoms of abortion are swelling of the udder and vulva, a muco-purulent, odorless discharge from the vagina, which may be streaked with blood.

Animals may abort, however, without any premonitory symptoms. If animals abort in the early stages of pregnancy, the foetal envelopes will be expelled with the foetus, but when abortion comes at a later stage the membranes are invariably retained for some time.

Following the abortion, in later stages of pregnancy particularly, there is a typical vaginal discharge continuing for several weeks; this discharge is of a dirty brown or reddish brown color, sticky in character and adheres to the tail or other parts of the body with which it comes in contact. Gradually the discharge becomes lessened and may finally cease.

There is always a pyometra or endo-metritis present which is primarily due to the abortion bacillus followed by a mixed infection.

Sven Wall claims that the endo-metritis caused by the abortion bacillus "seems not to occur or is rare." He states that the secondary infections are of a more serious nature than the abortion infection, and "they sometimes end fatally by septic and putrid intoxication or by bactereamia; sometimes they lead to a chronic metritis or pyometra, which heals more or less slowly and often leaves an atrophy and sclerosis of the mucous membrane of uterus, and the wall of uterus may be thickened." The cervix will contract but the wall of uterus oftentimes loses its tone and may be flaccid.

The pyometra often leads to a cystic degeneration of the ovaries, of the corpus luteum, manifested frequently by nymphomania. It may also lead to a salpingitis or inflammation of the oviducts. The oviducts may become cystic or there may be a pyo-salpinx or purulent collection of the oviducts. All of these pathological changes in uterus, ovaries and oviducts produce temporary or permanent sterility, which is a source of greater financial losses to the owner of valuable dairy or breeding animals than is the abortion itself. The sacro sciatic ligaments drop lower and lower, giving the spine a humped up appearance in front of base and tail.

Diagnosis.

From the standpoint of the practitioner our means of diagnosis in the past with the idea of protecting the owner in the spread of the infection to healthy pregnant animals has been our greatest problem. The premonitory symptoms, if there are any, are not noticed and are of very short duration and there are no specific symptoms or lesions until the abortion occurs. The bacillus cannot be found in uterine or vaginal discharges until just before and following abortion.

McFadyean and Stockman first introduced the abortion test. Our experience with it in this country has been anything but satisfactory. Animals reacting to the test would be removed from the herd and after a short period a number of those which had failed to respond to the test would abort, while the ones that had reacted would continue to carry their calves to full time.

We were then recommended to have laboratory men make the precipitation, the complement fixation and the agglutination tests. The practical results obtained from these tests in our experience were not much better than when we undertook to separate the diseased from the non-infected ones by the abortin test. However, it is the concensus of opinion of investigators that the agglutination and complement fixation tests are the most reliable and if they are able to make a series or succession of tests on the animals in a herd, they succeed in finding the infected animals.

These blood tests, when successful, are only of use in detecting the infected animals and do not indicate the degree of infection, as a cow which reacts may not abort but may show other symptoms of the disease. She may react and be an immune animal. They will thus prove of value in the early detection or diagnosis of the infection in a herd where there is a question of diagnosis. All abortions, premature births, retained afterbirths and sterility are and should be treated as symptoms of this contagious disease.

Immunization.

Some investigators have concluded that because abortion is more common in heifers and after they have aborted from one to three times and then cease to abort, they have acquired a natural immunity.

Sir Stewart Stockman, in 1914, on immunization stated "immunization appears to promise the best solution of this difficulty. It is admitted that the majority of cows do not abort at two successive pregnancies, and that this is due mainly to a certain degree of resistance having been acquired from the first attack of the disease, as is the case of many other diseases. Unfortunately a considerable number of cows do abort twice in succession, and a smaller number may abort three times. It is possible that this is due partly to some of the animals not having had a large enough dose of infective material to render them sufficiently resistent to infection; it may also be that the virus had not acted long enough to produce immunity, or that some animals are not so immunizable as others, and we know that this applies in relation to other diseases."

Dr. Williams states that an animal that has aborted once or twice does not become immune but is more liable to abort again or be sterile, to suffer from premature birth or retained afterbirth than a cow which never has aborted. He says, "Immunity cannot come as a result of disaster. If immunity is to be secured it must be considered as a consequence of the presence of the infection in the system and not as a result of a disaster which it may have occasioned. There is no more reason to expect immunity from abortion than there is from premature birth or retained afterbirth. Yet we frequently observe that a cow which has retained afterbirth one year is very liable to have it again the succeeding year, and in our clinic we have followed some cows with retained afterbirth through three succeeding years. In these cases we find that if the matter is followed closely and the uterus repeatedly and thoroughly disinfected, the retained afterbirth does not recur, but if the retained afterbirth is removed in the ordinary way and the animal then abandoned, the retained afterbirth or some other disaster

quite probably follows if she breeds again. That is, the one defeat by disease has lowered the vitality of the animal and invited succeeding disaster. If the infection which exists in the uterine cavity is not destroyed or washed away by douching it is retained there ready to produce disease again at the first opportunity. According to our data, a heifer which conceives at the first service, carries her calf for the normal period, calves promptly and expels her afterbirth promptly, is far more likely to repeat the performance during her second breeding year than is the heifer which has conceived with difficulty, requiring several services, or has aborted or given birth prematurely or has suffered from retained afterbirth. This is not in conflict with the generally accepted idea of immunity in infectious diseases. In those infectious diseases where immunity is artificially induced, it is brought about without producing disaster or disease."

Williams, in an earlier article, states, "Heifers in general are not so liable to abort in the second pregnancy as they are in the first, nor are they so liable in second pregnancy to have metritis with retained afterbirth. As the age of the animal advances, until old age with diminished vigor arrives, the constant tendency is to suffer less and less from the infection of contagious abortion. It is then an age immunity and not an immunity founded upon disaster."

In 1908 McFadyean and Stockman started some experiments with the idea of producing immunity. They have had encouraging results and Norris, of Dublin, recently stated, "Artificial immunity vaccination has now had a fairly extensive trial. It may be used to strengthen an already existing naturally acquired immunity, or to set up immunity in clean animals which might be exposed to risks of infection." In the same article he states, "Generally speaking it may be said the results so far show a decided but not striking tendency in favor of vaccination. It should, however, be used intelligently, a warning necessary in these days when vaccine therapy appears to be accountable for a good deal of promiscuous quackery of a pedantic type."

Mohler and Traum, Biltner and Bang have carried out experiments both with living and killed cultures of the bacillus abortus, but the majority of these experiments resulted unsatisfactorily. Schroeder and Cotton state that the abortion bacillus seems to have a peculiar affinity for embryonic tissue and that this brings with it the question whether the disease is not in fact primarily a disease of the embryo or foetus rather than of its mother. The mother, to be sure, is the source of infection, and possibly, if a large number of virulent abortion bacilli are poured into her body from her udder, antibodies of sufficient po-

tency may develop in her blood to protect her foetus. Should this prove true, good results in the treatment of infected herds may be expected from injections into the mother, possibly a short time before she conceives or early during pregnancy, of cultures of abortion bacilli, and it is possible that the more virulent the cultures are and the more abundant the material injected, the better the results will be.

The more recent investigations in immunizing with live cultures are encouraging and I understand that this method is now being employed in England on a large scale and with the best of results. The injection of living cultures, however, would not be advisable except in severely infected herds, as the animals injected may possibly become disseminators of the infection for a period of years.

Immunization by the use of abortion bacterins or killed cultures is now being recommended and widely advertised throughout the country by the manufacturers of these products. In the light of the conclusions and findings of the Bureau of Animal Industry and other investigators on the results of such treatment, the claims made for this treatment are unwarranted.

The Bureau of Animal Industry is now working on the preparation of an immune serum with a view to its use in infected herds, either in the form of a simultaneous treatment with dead or living organisms, or in other combinations.

TREATMENT.

Many medical agents, quack mixtures and concoctions have been recommended, bought and used by veterinarians and the owners of cattle, but none have proven to be of any value.

The use of carbolic acid was first recommended by Brauer, who administered it in small doses subcutaneously to the pregnant animal. Later, other investigators recommended its use in solution for administration by the mouth. Veterinarians in dairy and breeding districts immediately grasped this treatment in the forlorn hope that they finally had a cure and a solution of the problem of control of this disease. In some sections of the country we have able and conscientious practitioners who are satisfied that they are obtaining good results from its administration and some still regard it as a specific. In the researches of others and in our own experience we have found it to do no good.

Rich, of Vermont, later recommended the use of methylene blue as a remedy. He found that it was a strong germicide for the bacillus of abortion. Other investigators experimented with its use and invariably their results have been unsatisfactory.

Again the veterinarians and breeders grasped this new treatment with enthusiasm. In the breeding districts the cattle, their attendants, the floors of dairy barns, the milk secreted and the urine excreted were saturated with methylene blue and still contagious abortion continued in the herds and continued to increase throughout the country.

There is no question but that in individual herds where either the carbolic acid or the methylene blue treatment has been used under the direction of a qualified veterinarian, some good results have been obtained, not from the administration of the drugs but from the sanitary precautions and measures which have been used in conjunction with the treatment. It is a known fact that we can succeed in getting an owner to practice sanitation in his herd, if he is also given some remedy to administer to the animals. In all instances where practitioners claim to have had good results from the use of these drugs, we will find they have used disinfectants liberally in the barns, have isolated the aborters, flushed the vagina, removed the afterbirths, washed the external genitals and thighs of all pregnant animals, etc. They have thus succeeded to a certain extent in controlling the disease.

This disease, like all other contagious diseases, appears in waves or cycles; in other words it may be a severe one, two or three years and mild or entirely disappear the next succeeding year. A herd may have been so generally affected with disease that practically all of the heifers and many of the cows will abort, and those that carry the calves to full time give birth to young which die from white scours, pneumonia or other affections resulting from their weakened condition. Thus the herd is depleted of its young animals, the older animals have acquired a natural or age immunity, or have become sterile, and unless new heifers from outside sources are introduced into the herd the abortion will have subsided.

If any treatment is undertaken in these particular herds at this time, the veterinarians and owners could possibly draw the wrong deduction and conclude that the disease had been controlled by the specific treatment or drugs administered.

CONTROL.

1. Clinical diagnosis, where not positive, should be confirmed by agglutination or complement fixation tests in order to detect the disease early. We should remember, however, that these tests only detect infection and do not indicate the virulence or severity of it.

2. Remove aborting animals, those who give birth prematurely, animals with retained placenta and those that show premonitory symptoms of abortion, to a quarantine in separate

stables. They should not be allowed to remain in the stables or pasture with the rest of the herd. A close vigilance should be kept for abortion in early pregnancy as they often escape notice. All animals which have aborted and those with retained afterbirth and uterine discharges should be kept in quarantine and not be bred back for a period of two months or until the uterus has regained its normal condition. They should be kept in strict quarantine until all evidence of uternine and vaginal discharge has ceased. Treatment of these animals should be faithfully carried out and a large percentage of cases you will be able to prevent sterility and they will continue to be useful and productive.

Foetal membranes should be removed as soon as possible if it can be done without force. The uterus should then be douched with a mild antiseptic and the fluid carefully drawn off. A mild solution of boric acid, permanganate of potash or therapogen should be used. The latter can be used as strong as three per cent and will not produce any irritation or straining.

Schroeder and Cotton condemn the use of astringents at this time and claim uterus should be flushed with large quantities of a mild antiseptic. They claim that the abortion bacillus will not live in the uterus longer than fifty days and that astringents will do more harm than good. I am of the opinion that perhaps from a practical standpoint, they are right in this advice in those cases in which the animal has aborted early in pregnancy and the foetal membranes have been discharged with the foetus. But in the cases of abortion or premature birth, in which the membranes are retained and an endo-metritis or piometra results, we must use more radical antiseptic and astringent treatment.

Williams recommends the introduction of Iodoform in one-half ounce quantities in capsule or in suspension in olive oil, in cases where the foetal membranes are retained. This dissolves slowly, does not irritate the uterus and prevents decomposition and the extension of the infecting process.

As a douch Williams recommends a two per cent solution of Lugol's solution, which should be siphoned out and then followed by a normal salt solution which should also be siphoned out. The douching should be repeated once a week until the uterus and cervical canal are normal, then animal should be bred. The cystic degeneration of the corpora lutea is always associated with the chronic endo-metritis and, by dislodging the diseased corpus luteum and disinfecting repeatedly the uterine cavity and cervical canal, you will succeed in getting satisfactory results.

I have had some wonderful results in the past year in animals which I have had the privilege of treating immediately or shortly after they have aborted, by following Dr. Williams treatment.

I have also had some good results in treating old chronic cases of sterility in animals which had been sterile for years as result of diseased genital organs from this disease, but I have been doing this work systematically for a period of about seven months only and do not wish to go on record with any data at this time. Dr. Williams is getting sixty per cent of his sterile cases pregnant.

Until within the last eighteen months we have been unable to properly disinfect the uterus and succeed in removing all of the fluid. Now the operation is greatly facilitated and if one is careful it can be done with practically no danger to the animal by the use of instruments which were originated by Albrechtsen, of Copenhagen.

I wish, at this time, to advise you never under any circumstances to give an instrument, tube or catheter to a herdsman or owner with the advice to him to continue the flushing of the uterine cavity, for sooner or later there will be disastrous results.

3. All pregnant animals, a few days prior to calving should be thoroughly bathed, if possible removed to a box stall which has been cleaned and disinfected, the vagina should be douched, the tail, thighs and udder washed with a mild antiseptic. The new born calves should be allowed to suckle the mother for a period of ten days after birth, but the vagina should be douched, the thighs, tail and udder washed with antiseptic each time before allowing calf to suck. Some prefer that the calf should be fed, when the cow should be washed and cleaned in the same manner, the milker should disinfect his hands, the first few streams of milk be discarded in a separate vessel and not on the floor, and the milk should then be drawn into a sterilized vessel. Feed calves on boiled milk after they are ten days old to prevent infection of bacillus abortus and colon bacillus which often co-exist.

4. Sheaths and penis of bulls should be disinfected before and after each service; the vagina of heifers should be douched with a mild antiseptic and followed with normal salt solution before breeding.

5. Milkers should be required to wash their hands with antiseptic after milking each cow.

6. Prevent gross infection by the proper disposal of foetus, placental membranes, premature calves, uterine discharges, etc.

7. Infected stables should be thoroughly cleaned and disinfected, then white-washed periodically. Chloride of lime should be added to the white-wash.

8. Good air, sunlight and drainage should be provided.

9. Advise owners as to danger of abortion from the establishing of breeding blocks where several breeders use the same bull.

10. Advise clients when purchasing cows to select animals with second or third calf if possible and they should be kept in quarantine until calving before being introduced into herd

11. Advise against disposal of valuable animals which have aborted, as it only spreads disease and is not economical, as cows that have aborted are less apt to short again than the young animals and have acquired a greater degree of resistance than newly acquired, susceptible animals.

12. Examine and destroy all animals which have become unprofitable because of incurable sterility.

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Dr. Bemis: I am sure that we all realize now the value of this paper that we have just heard, and the more you think and work along these lines, the more you will realize the value of it. We are going to give opportunity a little later for a thorough discussion of this whole matter, but I thought it would be well to round up the whole subject before discussing any of it, and I have asked Dr. Dimock if he will introduce Dr. Moore.

Dr. Dimock: Gentlemen and friends: I was in hopes that Dr. Bemis would ask me to do that; in fact, I felt sure that he would ask me to do it. He always seems to have the ability to appreciate what the other fellow would like to do. To the practitioners and some of the students who are here and others, I simply want to say that I got my inspiration for the line of work I am doing from Dr. Moore, and in introducing him to you, it seems there is not anything better I could say than this. In teaching work I am not saying that we should not make students work, kind of hold their noses down on the grindstone perhaps more or less continuously. There is some difference of opinion possibly regarding that among teachers and I know there is quite a difference of opinion among students; but I feel there is another phase of teaching that is vital if you are going to accomplish the great task that we want to accomplish in turning men out from college; and that

is to put into their system the inspiration and desire so that they have a general comprehensive knowledge and feeling. I do not know how to describe this feeling, but it is something that comes into your system, something I have never been able to analyze. In fact, it was this inspiration along with other good things that I got from Dr. Moore, and it is one of the things that makes everybody who comes in contact with this man, appreciate him. Dr. Moore.

CORRELATION OF OUR PRESENT KNOWLEDGE REGARDING INFECTIOUS ABORTION IN CATTLE.

V. A. Moore,
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Mr. Chairman and gentlemen: I am exceedingly impressed after hearing this splendid paper by Dr. Cotton and hearing about the splendid papers you had yesterday on this subject, which I did not have the privilege of hearing, and to try in any way to correlate the knowledge of infectious abortion, I must say there does not seem to be any way yet by which it can be done. I appreciate, as you do, the position of the man who has cattle that are aborting and the desire of the practitioner who is this man's adviser to tell him how to get over his trouble, but I also appreciate the difficulty of the man telling the other man how to do a thing that he does not know how to do himself, and that is about the position we are in in connection with infectious abortion.

I wish that those of you, especially students, who are in the formative period, would read the life of Lord Sidener, who many years before medicine got on a rational basis pointed out that *disease is an object of natural history* and to study and understand the disease you have to study and understand it as you undertand a species of plants or a species of animals, and you know that in these species you may find individuals in different stages of development. You know that under different conditions you find the same species giving very different manifestations. Now, when you know the species, when you know the plant, know how it looks as a sapling, how it looks as mighty tree and in all the stages between, when you know how it looks under its best conditions, and how it looks just below the snow

line on the mountain under very adverse conditions, you have an understanding of the species and are able to recognize it and have an opinion and understanding of it under any condition you may find it.

Now, I believe that that is the situation in regard to this particular disease, not only with this, but with many other diseases. They have not been studied as objects of natural history; they have not been studied as entities in the organic world. I refer now to specific infectious diseases. A man sees just one phase of it and he attempts under the homeopathic idea of treating a symptom to deal with one particular phase, but he does not know the others. He does not know the relation of environment, and secondly he is very apt not to get the right thing after all.

Someone has said that the easy things in medicine have already been done. Those of us who are working on the etiology of the infectious diseases or working on the tissue changes in a general disease, realize more and more that the human mind has not come to a very clear understanding of Nature's processes in the development and management of these parasitisms, as these infectious diseases are. We do not understand them well enough. I have felt and do feel that the more we study this, the better understanding we get and the less we are carried away by the opinions perhaps of men who have a right to have opinions, until we come to know and understand the beginning and end, the better results we will have.

We are in the habit of feeling, and it is necessary and perhaps nothing wrong about, but it is one of the things that needs correcting—that *we are not inclined to get at the bottom of things before we attempt to use them. You cannot use knowledge until you have it.* You cannot properly direct a course of treatment until you know why, until you know the rationale, and, of course, the treatments that are given for various unfortunate conditions are always with the best of intentions. There is a desire to relieve the individual, but after all that is not Nature's way always. The individual does not always count, and consequently, the thing we should do before we attempt to apply knowledge in regard to infectious abortion, is to find out a little more about it. The same thing applies to tuberculosis; it applies to practically everything developed in the last 20 or 30 years in regard to infectious diseases, especially the things that have not been clearly understood.

Many things have been revealed to man so he understands them, but a great many he does not understand. Consequently we want to prepare ourselves with an understanding of these things before we attempt to use them too much. I do not think

anything could emphasize what I have said more than the splendid paper of Dr. Cotton that you have just heard, where these people differ so much, and to further emphasize and point out how difficult it may be.

There is a book written on bovine tuberculosis by one of the best men in the country, a government bulletin, in which it is stated that when the primary lesion occurs in the lungs of cattle, it occurs in the principal lobe. That bulletin was written based on a large series of examinations, several hundred series. Several years after that, another man, not so skilled a pathologist but a good observer and who had more than 1000 post mortems to draw his conclusion from found that when the primary lesion was in the lung, it was not in the principal lobe, but in the Anterior or cephalic lobe. Now what are you going to say, or what am I going to say, as to where in the lung the primary lesion is going to be. The next 1000 cases may be somewhere else.

Now, I feel it is somewhat of an imposition that with what little knowledge I have of this subject to attempt to go over it any further, this subject of the cause of abortion and the way it is spread, but like reading textbooks. we all go at the thing with different points of view, and possibly it would be pardonable even to review a little of that which has already been said

In the first place, in regard to the cause, I do not think there is anybody now who doubts but that the germ that Bang discovered as the cause of infectious abortion in cattle is the one. I do not think any one has any difficulty particularly in finding that organism. The methods or technic for the isolation of this organism from the infected animals have been worked out. It is a long and laborious technic, and still it has been simplified until now the isolation of the germ is not so difficult, and we have then this particular organism that can be isolated from the cases due to it.

Now, the question that has come up recently in our cases has been as to whether this particular organism was the cause of a great many abortions. I am sure we have no information on that point. I know some years ago in talking with Dr. Paullos in Holland, he felt that other organisms were the cause of the expulsion of the fetus in a good many cases, and so I think we must have open minds to the fact that a certain number of abortions, expulsions of the fetus, may be due to other organisms than this. But the disease, the condition that we speak of when we refer to contagious abortion, I do not think anybody now questions that it is due to this particular germ. As I say, its characters, its biological properties, its resistance to disinfectants, all these I think are pretty clearly determined.

There is a considerable difference in the findings of people in regard to them. Fabian found that 59 degrees Centigrade for ten minutes was the minimum temperature and duration that would destroy this germ. Now, we must remember naturally that on the question of disinfectants and the thermal death point, a great deal depends upon the condition that exists and a great deal depends upon the age of the organism perhaps. We forget that bacteria, small as they are and rapid as they are in their multiplication, have I think an old age as have higher and more complex individuals, and that in the germinating stage they are very rapidly destroyed by both heat and disinfectants, whereas in the adult stage they are more resistent. Consequently, when you read that one man found a temperature at one point and another one at another and one finds a certain strength of disinfectant will kill and another one another strength will kill the germ, that does not mean that any of them were necessarily wrong, but that they have stated a single isolated fact, that they have not stated the effect of the disinfectant on the germ during its whole life time from its birth to its old age, and possibly they have not stated the action of the disinfectant on the organism when isolated from every substance that might protect it to a greater or less extent. So these differences may all be corrected, and yet none of them may present really the particular thing that we should apply. It simply means that we must heat a little higher and disinfect a little stronger in order to overcome what may be called physiological differences.

In regard to the distribution, we have a difficult problem. Dr. Williams believes that this germ is pretty widely distributed. He thinks it is present in pretty nearly all herds, whether they are aborting or not. He feels there are very few herds in which retained placenta, metritis, etc., do not exist, and that this organism is pretty much the cause of these conditions as far as the expulsion of the fetus which is only one part of the disease of contagious abortion, or as the Bureau of Animal Industry has called it, abortion disease. It may exist in the normal animal and under certain conditions manifest itself. While we do not feel that way, we have no particular data to disprove it. That is a point we want to keep in mind.

You take tuberculosis for instance—the same thing holds. You take hemorrhagic septicemia—the same holds. It has been said that the organism of hemorrhagic septicemia was a wide spread organism existing everywhere. We know that that organism is present in the air passages of a large number of healthy animals where it does not do any harm, but if injected into the tissues, it seems to produce disease. Conse-

quently, we cannot get away from the fact that this organism has acquired a certain pathogenicity.

Abortion disease in certain herds gives rise to explusion of the fetus, whereas in more cases it is chronic and manifestation is shown in the chronic form of metritis which leads to retention of the afterbirth and perhaps ovarian troubles later, so we have to get the conception of all this as an entity of the disease before we really can consider it.

In a bulletin that was published years ago by Dr. Theobald Smith and myself on this hemorrhagic septicemia group. We used that rather stale formula that is used in physics and other places in regard to this point, but I think if you will keep it in mind it will help you to understand the entity of this thing. Assuming we are working on the hypothesis that this germ is widespread, if that is the case and its virulence is sufficiently low, we do not know it is present at all. If it gains in its virulence, we may get a form of disease different from the other, such as retained placenta.

$$D = \frac{V}{R}$$

"D" represents the form of the disease; "V" the virulence of the disease; and "R" the result of the whole. In this case there is perhaps retained placenta and in another case ovarian trouble, and it would bring about a reaction sufficient to cause expulsion of the fetus and you call it abortion, but the whole thing goes to make up the symptom complex, of this phenomenon.

Now if that is the case, you can readily understand what a difficult thing it is to explain the ground of being introduced by single individuals among animals. A number of experimenters have found that the question of isolating the cow that aborts or bringing in of animals from the outside, has little to do with the abortion. Others feel that that is the main source of infection and the main cause of the trouble. If it is a specific, highly developed pathogenic organism like anthrax or tuberculosis, then it must be communicated by one individual to another; then it is brought in by the chronic or acute cases and spread from individual to individual. But what are we going to do? We are in doubt. Each of us has, I think, his own personal ideas and convictions about it, but we do not know that we are right. It is exceedingly important that we know we are right about these things before we advocate them.

My own personal opinion is that this germ is not so widespread that it is more specific and that it has been carried about as germs of other infectious diseases have, and that it has gotten into a large number of herds through natural channels the same as tuberculosis, that it is specific, is carried and is spread in certain definite ways, but I do not think we know all those ways.

Then there is the question of the dissemination of the disease. How is the germ eliminated? In the control of an infectious disease, there are only three or four things to keep in mind, three or four fundamental things, and if these things are understood, the control is very simple, and these are (1) how, (2) when, (3) through what channels and, (4) where is a virus eliminated from the affected individual, (5) what happens to it after it escapes from that individual, and (6) how does it get into the new host. If you answer these question, if you tell me (1) how the virus escapes from the affected individual, what time and courses it takes to get away, (2) what its powers are of resisting death after it is out of the body, and (3) then how and through what channels it gets into the next animal—if you answer these questions, you can put a barrier in anywhere there, and prevent further spread. They are going about talking about a great many things, but these are the things to find out. These are the three things, and if you know these, understand these, it seems to me there will be no trouble, and I think when these are understood and known, this disease will drop down very materially in its seriousness.

We know this about it, that it does escape from the discharge from the uterus after abortion. That is a fact that is known. It has also been found that this organism is in the milk. Sir John McFadyean six or eight years ago pointed out the fact that the udder was the place for the up-keep of this organism, and then our fellows over in this country got hold of it and they have said a good deal about this germ in the milk, but it was pointed out that it got into the udder. Dr. Schroeder's paper which Dr. Cotton referred to, tends to lead one to believe that the organism gets into the udder first and passes into the fetus. Does it? If it does, how often does it do that? Is that the usual way for the spread of the infection? In the process of infection, shall we look for udder infection first and then uterine infection, or shall we look for uterine infection and then udder infection? The examinations made by such men as Smith and Fabian show that they found this organism in the milk cows that have aborted and in the milk of cows that have not aborted, where, in other words the germ could have been carried from one udder to another. If you know how in the udder a great many organisms may get up

through the teat and become localized there and understand how this germ could be carried from a cow that had the germ in her milk to another that did not have it in her milk, then you can see how it might occur that way and the organism go up though the teat into the udder. If an organism is able to live in the udder, it could get up that way. But they have not shown that that is the way the animal gets infected—through the udder in the first place and the uterus in the second place. It seems to me that the germ is present in the first place, in the uterus and then in the udder.

McFadyean's theory was that the germ gets on to the end of the teat from the discharge from the vagina and then the germ goes up into the udder and that the organism remains in the udder because it is able to live there for a considerable length of time. It has been shown to be there for many months. You cannot dispute the accuracy of the observations as to the length of time the germ stays there, but it is the interpretation of it. Now if the organism gets into the udder from the uterus and then if the calf becomes infected with the milk, the germ getting into the udder from the uterine discharges, that germ is not going to get there very quickly, so that under that condition, you can feed the calf milk from the cow for a few days without affecting it. On the other hand, however, if the germ is in the udder first and abortion has been brought about by the infection, then I see no reason for feeding the calf the milk after ten days, even if it is boiled milk. It may be all right as the calf may not be so susceptible after ten days, but I think differently.

Sir Stewart Stockman and McFadyean did claim that the organism is eliminated from the uterus in six weeks after abortion. It was my privilege in 1908 to be in London and to be with Sir John McFadyean when he tested out the complement fixation test. It was the first time it had been done, and I was with him when he ran through his second or third test. I stayed over a few days to work with him in the laboratory when he did it, and McFaydean gave an address to veterinarians on this. He pointed out about this organism and its elimination and recommended what was the basis for the theory of immunity at that time, and I do not say that it has changed, but the fact was that they would inject living organisms and produce immunity in the animal and the organisms would be eliminated. If the cow was fresh they began to inject her with the living culture but stopped at least two months before she was served. Now according to the theory, these organisms had become eliminated, but if they did not become eliminated in that time, I do not see how the theory would work.

We know that immunization has gone on, but that is the theory for it, that these organisms are eliminated in a certain way.

Now in the creation of things, this organism acquired some particular way to live, and I do not think you can understand an infectious disease unless you put yourself in the place for a time of these organisms. These organisms want to live, and the fact that they destroy cattle has nothing to do with it. We live by the destruction of a great many animals and we do not think anything about it. Now, if that is so they have to have some specific way to get around. It is so with every disease. Take malaria—how does it spread from one man to another? The mosquito came in to help it out. When they found Nature had provided for the spread of this virus, the whole thing was cleared up. When we get rid of the Anopheles, the malaria is stopped.

There is nothing contrary to nature that there should be this specificity of the disease and that it passes from the uterus to the udder, that it is maintained in the udder and the calf becomes infected with the milk and in that way the organism is able to live. It is just like any other disease. It is propagated, and we do not know but what that is Nature's way of doing it. We cannot say it is but we do know that we find it in the udder.

We are doing some work on the various forms of ovarian troubles, etc., making bacteriological examinations of ovaries from cattle that are slaughtered and find the organisms that are there. They are not all abortion bacilli, I assure you, but they are there sometimes, and it may be that that is the way. Dr. Williams has accumulated a lot of data, not enough to satisfy him, not enough I think to be convincing to anybody, but it is suggestive, showing that calves raised on the milk of aborting cows or raised on milk from herds where there are a good many aborting cows, invariably abort in their first pregnancy. If that thing holds, it may be possible that this cycle is completed. The calf becomes infected; the organism gets into the generative organs, in what way we do not know; then when this heifer conceives, a condition is developed with this organism so that the fetus is expelled, and the organism gets from the uterus that way through the vaginal discharges into the udder. The germ becomes established there and then the calf comes and gets the milk, and the cycle is completed. If that is true, it is an easy proposition, because you won't feed that milk to the calves. Then the germ will die and the disease will disappear. I hope that is true; I hope that that is the way this organic body has of getting around, because if is is, the control of the disease will be easy; but I do not know that.

In regard to the pathogenesis, it is a curious thing about this that the only lesions which we find in cattle, in aborting cattle apparently are the expulsion of the fetus, this exudate, possibly this retained placenta, this metritis and possibly the changes in the ovary. They are not worked out very well, but these are the only lesions that appear to exist in cattle. When you inject this into Guinea pigs, if you inject the organism into pregnant Guinea pigs, they will abort, and I have no data as to what would happen to pigs afterwards, because in all our experiments, we have killed the pigs to recover the organism from the uterus. But we know when we inject this into pigs that are not pregnant, into males, we get lesions. Surface outbreaks are described among Guinea pigs due to this organism. Infectious abortion among mares does not seem to be due to this organism, but the pathology of it seems to restrict it to the generative organs.

I killed a cow by injecting a large amount of these cultures into the vein. She had a high temperature and died in about five days, I think, having a temperature of 106 or 107. Five others injected at the same time had a high temperature but it went down in two or three days and they went on for several days, one 66 and a few 84, and they aborted, and we killed them and found this exudate in the uterus and obtained the organism and so on. Now it got from the jugular vein to the uterus in some way; that is, we thought it did. But these cows might have aborted if we had not inoculated them. I tried it over on five cows after that, and one of them aborted and the other four did not. Now what does it prove. Of the first five cows, one died as an immediate result and the others aborted. They all showed the typical signs and they came from one herd that so far as we could find out had not had any abortion, and they all aborted. When we tried to check it up and repeat it, only one of the five aborted, and the others went on and delivered their calves at full time with no evidence of abortion whatever. That opens up the difficulty of getting at a conclusion. When we come to take cultures from different sources, there seems to be a difference in the virulence, and that lends color to the conclusion that possibly these germs are widespread, and possibly through different conditions they gain virulence at different times. Abortion organisms in different herds show a pronounced difference in the animals affected with abortion and in producing lesions in Guinea pigs. So the problem is not so easy.

On the other hand, it may be that these animals we inoculated and they aborted, were susceptible animals and that the others were more or less immunized. That work was done before the sera test, and consequently we did not have that to

check it up. But the pathogenesis consists in this complex of abortion, metritis, retained after-birth and these lesions resembling somewhat tuberculosis in Guinea pigs.

In the diagnosis we are in great doubt. Dr. Cotton went over that so fully that I need not repeat, but we have in all infectious disease four things to guide us. We have the symptoms; the cause, which is positive in all cases; then the lesions that are produced, which are very characteristic in many diseases and in some diseases they are not; then we have the specific reaction, the response of the organims of the body to the specific protein of the organism in some form.

With infectious abortion, the symptoms, the lesions are, of course, the expulsion of the fetus, and that part of it is clear, but when you come to go into a herd, as a lot of people do, here is where the veterinarian has a great responsibility. People are very much interested and excited. They are panicky over this disease. Breeders are very careful in buying. They do not want to buy an animal, and if they are going to buy an animal, they want to test it, but how are you going to tell? You go to a herd and pick out an animal and your client wants to buy her if she is not infected, but you cannot get the evidence. You have to depend upon specific tests.

McFadyean and Stockman were very favorable to abortin some eight years ago, but they gave that up. McFadyean was very partial to complement fixation and he thought that was a sure thing, but now we hear a great deal about the agglutination test. Suppose you get a reaction, what does it mean? In testing these cows for your client, you send the blood to the laboratory and have an agglutination test made. If it is positive, what does it mean? Does it mean that the cow is infected and is going to abort, or has she been infected some time in the past so that she is now immune and is exactly the animal you ought to buy? You can interpret that either way you like. We have found that cows give positive tests and yet go on giving calves. We can inject the dead organism into a cow and they will give this reaction. You take cows that will not react and have them served, and then test their blood, and they will react. Has the bull transmitted this and is it possible for this change to take place in four or five days after the germ is introduced into the genital organs? It is a fact that a certain number of these cows will agglutinate after they have been served. We know certain calves will give an agglutination after a certain time; then they lose that power, and then gain it again. What does it mean? It means that we must know more about these things before we can establish methods of diagnosis.

In the East there is great demand for help along this line for making the test. Don't you see what difficulty you are going to get into, if you introduce any of these tests for picking out animals that will or will not abort? You cannot do it, and you are only going to bring discredit upon yourself.

Then there is the question of immunity. Dr. Cotton went over that. I do not think that we know. We have to consider here what is immunity and the varieties of immunity. We do not find that abortion is a toxic disease. It is a bacterial disease, if anything, and there is a difference between a toxic immunity and a bacterial immunity, and those of you who have studied that subject, when you stop to think about it, will see how difficult it is. With a toxic disease, there is no difficulty in immunizing animals and producing antitoxin, but with bacterial disease that produce pronounced tissue changes like tuberculosis and perhaps abortion, the trouble is due to the tissue changes or exudates and not to the toxin; consequently, how are you going to produce immunity? You know what they have been doing with tuberculosis and glanders. We cannot get a practical immunity. We have no practical way of producing bacterial immunity in chronic infections. Until we get the keynote of the principle of doing it I do not see any hope of going ahead and establishing immunity. We are trying experiments to see what can be done. We are trying to verify the results obtained by Sir Stewart Stockman, but they are not at all promising. A lot of fundamental basic work has to be done before we can tell about these things.

In regard to treatment, you men in practice should know more about treatment than I do, but there is a great deal in what Dr. Cotton said. If you give a man something to do and tell him to clean up, you will get good sanitation carried out that you won't get if you do not give him something. That reminds me of a story of a lady who was an invalid. No one could tell what the trouble was, but she could not get out of bed. Finally one day the doctor left some medicine in a hopeless sort of way and it was very disagreeable to take. So he told her she should take that medicine in any convenient vehicle. She interpreted "vehicle" to mean a four-wheel carriage, and consequently with a great deal of trouble, with the help of her nurse and maid, she got into a four-wheel phaeton, and while in this phaeton she took the medicine. She repeated it daily and she got very much better. When the doctor came and found her interpretation of the term "vehicle", he said it was all right, and she got well. If he had told her simply to take the medicine, she would not have gotten out into the carriage and would not have recovered. The thing is to give the owner something to do.

Various medicines or remedies like carbolic acid, have been tried out, and if you go through the literature, you will find a lot

of statements and conclusions. I know of several large herds where they are using carbolic acid, and they claim they have conquered the disease. Is there any basis for it? The only basis I know of, is that the statement has been made and some experimental work reported, that if you inject 4 per cent of carbolic acid, you will stimulate leukocytosis. Now if you can bring about a high degree of inflammatory leukocytosis in an animal, there is not any reason why you should not have accompanying it phagocytosis and this organism is destroyed. I do not know whether there is anything in it or not, but the experiment has been made, and they say you can get leukocytosis in this manner, and if you can you get phagocytosis, and if you get that, I do not see why you may not get good results. It may work in some cases and not in others.

Now methylene blue has gone the route. Still I know people who claim methylene blue is the only salvation in their herds. Others say it doesn't amount to anything. Now does it or not? The truth is we do not know anything about the disease, and you can't produce it when you want it, and it will come when you don't want it.

Then with the vaccine, there has been an enormous amount of work done, and companies are putting out vaccine which may be good, but I don't know (Schroeder and Cotton say of no value). We do know, however, that where proper general sanitary methods are carried out, where sexual hygiene is carefully observed, good results seem to be obtained, and I think if we would gather up the results from all of these people and get all together and analyze it, we would find that those veterinarians who are carrying out a general hygiene, general cleanliness, clean stables, clean cattle and sexual hygiene, are following the proper teaching. That must be done properly. I am not a clinician and cannot discuss that except as to right and wrong. You must not use too strong solutions that will do more harm than the organisms themselves. If this hygiene is carried out, we may get good results, but I think the people who are following that out are going in the wrong way to get the best results, and as Dr. Cotton said, we have not gone far enough to know that that is going to be the proper course.

Several years ago when the disease first came into this country, they did not do anything that could be considered as a remedy. Now are these good results following these methods of using methylene blue, carbolic acid or general hygiene? Are they accomplishing anything or is it an accident? That must be determined, and it cannot be until we get a little more knowledge of the subject. *We must keep in mind always that as professional men we must be teachers, advisers and leaders in our communities, and to do that we must remember that we cannot apply knowledge until we have it, and it will not do to base our reputation*

upon some remedy, some product that somebody has reported successfully, because if you look at the other side, you will find that many of these herds have had trouble and have gotten out of it in the past without these remedies. I do not like to say that it is discouraging, but there is no use of deceiving ourselves. I think the man who deceives himself is the worst fooled man in the world. We cannot do these things until we get the knowledge. We do not know how this disease got into this country, and it is pretty widespread, and we have to find data. It may be three, ten or twenty years before we know the course of this infection, and until that time comes we are going to flounder about more or less; but the thing to do is to try to get the natural history of this disease, how it is spread, and when we find that, it is not going to be difficult to step in to break this infection that seems to be going on.

I have taken a good deal of your time, and I do not think I have said anything that will help you, but in this thing you must be careful and get at the facts and carry out this therapeutic maxim—if we do no good, we must be sure to do no harm.

Dr. Bemis: To me it has been very interesting to hear a talk of this kind. As Dr. Moore said, the people are more or less in a panicky condition about this disease and other diseases, but it is comforting to know that there are certain principles to which we can go back, upon which we can base our arguments and our belief in the action of all organisms.

AFTERNOON SESSION, JANUARY 12, 1917.

Dr. Bemis: There are so many questions connected with the problem of contagious abortion and its complications that I think we ought to take a little while to give opportunity for questions to these men who have done so much work on this problem. So I am going to ask you to ask these men questions and bring up points to discuss.

Dr. Griffith: I should like to ask Dr. Cotton a question. I was called out to a farm and the owner had a cow that aborted two twin calves the night before. I proceeded to remove the placenta and found a mass of something like whipped rope. I started to pull and hemorrhage commenced, and I reached away in there and still found that same material. I should like to have the treatment for that case.

Dr. Cotton: As a rule you have an immense uterus that you cannot feel the bottom of. I would leave that membrane there and would not put any traction on it whatever. I would flush that animal with some mild antiseptic, preferably therapogen. If there was any smell, I would inject camphor suspended in olive oil and leave it there according to the condition of the

animal, and I should want to come back and continue to flush that animal; but I do not believe you will be justified in putting traction on what is left there. You simply tear it away and leave chances for resorption infection.

Dr. Bemis: Suppose you had the opportunity to follow up this case and you found that very soon the cervix contracts more or less completely, what would be your treatment then? Would you attempt dilation so you could treat the uterus more directly, or would you depend upon irrigation through the tube to remove those shreds of membrane that still are retained?

Dr. Cotton: I would absolutely depend upon irrigation through the tube, and under these conditions, instead of using the metallic catheter, use your rubber horse catheter. You may find a good deal of trouble when the cervix is contracted in introducing your horse catheter through the cervix, but if you will take your dilator and push it into the opening in the side of the rubber catheter, you can very easily introduce that with the dilator the same as you would with your metal one, but with a horse catheter you can work around and get into the horns, which you could not do with the metal catheter. We know that because with the return flow that comes back, if you repeat again, you will find foci of pus that you could not get with the metal catheter. More and more I am depending upon the rubber catheter, particularly in those cases where there are some shreds retained. I would continue to flush weekly, of course. Sometimes it takes months. Particularly in those cases of pyometra where you have pus and the infection is well forward, you have to go into the rectum with your hand and massage.

Dr. Quitman: I have heard so much about, what do you do with the fluid in the uterus? This has made me wonder why not take an easier procedure, and instead of trying to siphon it out, why not flush out whatever solution you use with normal salt solution. That is something that every man can make up, and if it stays in there it is not going to do any harm but will actually be beneficial. Why not flush out the uterus with normal salt solution in stead of trying to siphon it out or trying to press it out. I should like to know if any one can see any objection to that. The fact of the matter is I cannot possibly see any objection. Whatever remains in there cannot do any harm, and we know normal salt solution is beneficial, and if there is any post-operative shock there, the normal salt solution is apt to do some good in that regard.

I want to call attention to something that is not generally known. We used to figure normal salt solution at six-tenths of one per cent. We used to figure that as normal human salt solution. Then physiologists found that was too low, so now they figure the human

normal salt solution at eight-tenths. With lower animals it is a little higher and should be figured at eighty-five hundredths or you might say nine-tenths per cent, or in making up the solution if you figure one per cent, you will not do any harm with it. But those of you who have the idea that normal salt solution is six-tenths of one per cent might look it up, and you will find that that is too low.

Dr. Bergman: I might say that in the laboratory anywhere between six and nine-tenths per cent will prevent much hemolysis. A one per cent solution will cause some shrinking of the corpuscles.

Dr. Bemis: I might give my opinion in answer to Dr. Quitman's first question regarding the normal salt solution, that it would be my opinion that the ideal condition in which to leave the uterus would be absolutely dry after its surgical dressing, whatever it may be necessary to give it. I always feel that I would like to lay that uterus wide open and sponge it out with sterile gauze. Of course, we can't do that, but I like to get as close to that as possible, and it has been my idea that any considerable amount of fluid, even though it might be normal salt, is injurious to the uterus.

Dr. Quitman: Common salt would be absorbed quickly.

Dr. Bemis: That is what I want to ask. Does any one know that it is not injurious or that it is beneficial to leave fluid in the uterus?

Dr. Quitman: I can say positively it is not injurious, and according to my observation, it is beneficial. The normal salt solution is very readily absorbed, and what might remain would be a very small quantity. It is characteristic of salt solution that it will be absorbed.

Dr. Bergman: If there is inflammation of the mucous membrane, the absorptive properties are interfered with to a considerable extent and there is a possibility that the fluid might remain some time and prevent the contraction of the uterus which is desired.

Dr. Cotton: Personally, I am satisfied that in the acute cases, such as Dr. Griffith spoke of, we should get out all fluid. No matter what the infection, if you have fluid you have something there in which the growth may continue. In endometritis, we continue to flush the uterus for months and months until we have no discharges. That discharge is a thick muco-purulent discharge, and our custom has been to flush it with Lugol's solution and wash it with normal salt solution, and undertake to get that out also. I am satisfied if you would follow some of these animals to the slaughter house and hold an autopsy and see the condition of the

mucous membrane of that uterus, you would see it is impossible to have any absorption from that thick lining of the uterus. I am satisfied nothing could be absorbed there in these chronic endometritis conditions.

Dr. Quitman: I might ask Dr. Cotton if he ever put normal salt solution into one of these conditions and then tried to get any of it the next day. I do not think you will find any of it. Normal salt solution has a very peculiar quality. I admit I would not leave several gallons in there. If the uterus is in a flaccid condition, I say, siphon as much out as you can. I did not say acute cases. I said in any condition in which you flush the uterus, and I did not discuss the preliminary fluids used but referred to the emptying out of any fluid by flushing with normal salt solution.

Dr. McLeod: It seems that we are not getting at this subject just right. As I understand these cases, there are two different classes to deal with. In the case of the uterus with the open cervix, the flushing process would probably bring about results in time if it is persevered in, but the cases I refer to and in which I have the most trouble are the cases in which I have had a closed cervix, and in which we cannot get drainage. They are the stubborn cases and usually fatal. It is along the lines of these cases that I want information as to the drainage of the horns of the uterus after the cervix is closed.

Dr. Bemis: I can tell you the way I would do that. As I said yesterday, as far as I know, the only other method is with the use of instruments, fixing the os and cervix, and then dilate by using the uterine dilator through the os. This must be more careful and delicate, but it can be carried out, and usually without spending a great deal of time, and then the introduction of these tubes, the catheter that Dr. Cotton spoke of.

Dr. McLeod: I should like to say that I have used a catheter and dilator as discussed by Dr. Cotton, but nevertheless the outcome was very unsatisfactory.

Dr. Macklin: I should like to ask if anybody had any results with a cow with the cervical canal closed and all membranes retained, and I should like to know what would be the results if the canal was opened and the membranes removed. I have had a couple of these that died in twelve hours.

Dr. Cotton: We have all had some bad results and in these cases in particular, but if you had pus confined in a joint in a horse, you would certainly feel justified in cutting it and getting it out of there, and if you have a flaccid uterus in which the cervix is closed, you are perfectly justified in opening that cervix and flushing the animal thoroughly, and you want to make a rectal examination and know where you are putting the tubes and where you are

placing the catheter. I think there is some misunderstanding as to the use of these instruments and getting into the cervix. I want to say I don't think there is such a thing as a closed cervix of a cow. In these cases of pyometra and endometritis, I have never failed yet after going carefully to enter the cervix. After reading Dr. Williams' work, I was very careful in grabbing on to the cervix and fixing it. But perhaps I was a little too rough in getting through the cervix. After seeing Dr. Williams, I have changed my technic. He is careful in getting through the cervix. The cervix is three and one-half inches long. In those days when we did not have anything to fix the uterus and I was called by a farmer to open up his cow, I grabbed hold and tried and succeeded in making the owner think that I opened the cervix, but we never opened a cervix. It is full of folds, and when you attempt to put in the dilator, you cannot put it in with one effort. I have taken an hour to get through that cervix. The next week I will go out and happen to hit it perfectly. I do believe that you are justified and must open the cervix in the case you describe and flush her with a mild antiseptic and go back there the next day. As to the general outcome, it depends upon the animal's general condition and the amount of absorption, but you must get out all of the fluid, in my opinion.

Dr. Griffith: He is talking about a case where all the fetal membranes are retained. How are you going to get them out with a catheter? I have to get my hands in there. I don't know how you are going to siphon them out. The first thing the membrane will run over the hole and close it up.

Dr. Cotton: As a rule, under those conditions with the cervix closed most of them are all decomposed and a mass of fluid. You have to keep constantly flushing until they are all decomposed and get them out that way, and sometimes you have to work for weeks and weeks.

A Veterinarian: I have been practicing 27 years, and I do not agree with Dr. Cotton in not removing the afterbirth in the case that Dr. Griffith mentioned. The doctors of human medicine say a birth is not completed until the afterbirth is removed. I think the same applies to the cow. In regard to contagious abortion, we are taught that the uterus is the home of this bacillus, and I think the sooner that is removed and washed out the better chances we have of killing abortion.

A Veterinarian: One of the dirtiest and most distasteful operations that a veterinarian is called on to do is in my opinion to clean an old cow. The thing is dirty and it is not appetizing to thrust your arm up to the shoulder into the cow and perhaps get a kick on the shins, but it is like some of the other troublesome things of life. I do not believe that that purulent material is going

to be gotten out by slow macreation and under the influence of antiseptics. Here in Iowa we find our cattle owners refusing to employ a veterinarian for half a dozen visits to a cow. It has been my policy in a great many cases where the cow had a closed uterus so that it was impossible to insert the hand, to flush her out with an apparatus that is commonly found in most drug stores, a thing that is bought under the name of a stomach pump, a rubber hose three feet long and a funnel at the end, using a solution consisting of one to three grains to the ounce of potassium permanganate. I have left two or three quarts of this solution in the uterus in a great many cases, and I do not believe there is any detrimental effect. I believe that this permanganate solution coagulates the discharge and the material that comes away is not offensive. It is not as gluey to the external genitals as material used as an antiseptic with cresylic acid in its composition. It has seemed to me that the sooner we get the placenta out of a cow after she has disposed of her fetus, the less complications we have to encounter.

Mr. J. C. Winkjer: I should like to ask Dr. Cotton the effectiveness of stopping the spread of contagious abortion by disinfecting the bull. The reason I ask is that associations are being formed among the farmers to own the bull in common.

Dr. Cotton: I tried in my paper this morning to cover the status of the bull as a disseminator of infection and undertook to impress on you that authorities differ so much and that there was a great deal of room for experimental work on a big scale before you can make many practical deductions; but under conditions as they are at present, we must all look on the bull as a disseminator of infection to be on the safe side. It is very simple and easy to flush the bull both before and after his copulation, and what we have outlined in our work is to flush that bull with one-fourth of one per cent Lugol's solution. We find that you cannot flush the vagina of the female perhaps with as strong a solution as you can the male, but one-fourth of one per cent is sufficient. In our large herds we insist that they must flush that bull with a one-fourth of one per cent solution. We take a common horse catheter and have it attached to a common syringe and push this up into the prepuce and grab hold of the prepuce on the outside. It is very simply done and there will be no fight in doing it if the attendant does it.

Dr. Statter: In this connection, an instance that is occurring here in the northeastern part of the state now might be of interest. A community owned bull there happens to be part owned by a man who has had infectious abortion on his farm and has some sterility. The bull is particularly valuable, and they were loath to give up their use of the bull, but they have been very careful. I will say I believe these men are above the average in their appreciation of

bacteriology and disinfection, etc., and they have always disinfected this bull. They have disinfected the sheath and body chiefly with a weak solution of potassium permanganate and the solution retained in the sheath for some time and the sheath massaged, also the hair of his body pretty well disinfected by some coal tar dip. On this other farm where no abortion has occurred, I stayed all night not over two months ago, and made particular inquiry. This man has some cows he sold some time ago for $1,000. They are valuable and he knows their history. He has had no abortion and no sterility on his place. He has sold some of his heifers before they were due to calve and some before they were bred, and I asked him whether he had any complaints or comebacks, and he said he had not, but recently he said one person had bought one and was not satisfied. It seems to have worked very satisfactorily there. These men are firmly of the idea that the precautions they are taking are what is preventing its spread. They have been very careful on this one farm in burning up all the results of abortion and disinfecting the place, and I believe they have limited the abortion there.

Dr. Bemis: I did think we would get on some common ground in regard to these problems. In regard to one question that was raised, we all realize that the practitioner cannot always do what he would like to do. He is called at a certain time, and perhaps that is the only time the owner can afford to call him in that case, and he must do at that time the thing that seems to be indicated. We have in the uterus, particularly during pregnancy, a very delicate organ, which is highly vascular and has an arrangement of the vascular system and the lymphatic system for the purpose of bringing and returning blood to the part, and if in such an organ we have infection and on top of that a wound, it stands to reason that a wounded organ of this kind, which is also infected, is much more apt to result in general septicemia than if it were not wounded, and so I believe that whatever we may be able to do under circumstances at that particular time, we must remember these facts and handle them as best we can in order to avoid both wounding and infection.

We will continue by taking up the subject of tuberculosis, and Dr. Bolton will present a paper on Tuberculin Tests.

Dr. Bolton: Mr. Chairman and gentlemen: At this institution we have done no work on the different methods of tuberculin testing. We have done a great deal of testing of tuberculous animals, and, of course, we have used all the time the official tuberculin test, the subcutaneous method. In one herd I have in mind consisting of less than 100 animals, we found 60 per cent tuberculous, and some time ago in another community we tested something like 200 animals, and our estimate there of tuberculosis as found by the subcutaneous method was about ten

per cent. How many animals we left in those herds that did not react to the test, we do not know. My paper is limited to the diagnosis of tuberculosis by the use of tuberculin.

TUBERCULIN TESTS FOR TUBERCULOSIS.

R. R. Bolton, Ames, Iowa.

Tuberculin was discovered in 1890 by Robert Koch. Two years later, 1892, Dr. Leonard Pearson first brought tuberculin into this country and experimented with it as a remedy for tuberculosis in cattle. For several years following its discovery various investigators experimented with tuberculin as a preventative and also as a curative agent for tuberculosis of animals, but as such it was found to be of no practical value.

It was known, however, that tuberculin exerted a specific action upon a tuberculous animal, and consequently when it became established that it had no value as a preventative or as a curative agent it came to be used for purposes of diagnosis. Today the real value of tuberculin lies in its diagnostic properties, and so far as we know, the use of tuberculin is the most reliable means of diagnosing tuberculosis in the living animal.

The specific action exerted by tuberculin upon a tuberculous animal is characterized by three essential features:

I. A constitutional reaction consisting of fever and concomitant general symptoms, such as rapid pulse, depression, loss of appetite and diarrhea, these varying in severity with the intensity of the reaction.

II. A local reaction at the point of application varying in intensity from slight tenderness to a severe inflammatory process.

III. A focal reaction about the tuberculous lesions.

These reactions do not always all take place in one animal at the same time, nor with equal severity.

From many investigations it is known that this specific action is manifested and may be recognized in various ways depending upon the manner and the place in which the tuberculin is introduced.

This has resulted in the differentiation of various methods of diagnosing tuberculosis by means of the use of tuberculin. Those methods most commonly connected with veterinary practice are:

1. The Subcutaneous or Thermal.
2. The Intradermal.
3. The Ophthalmic or eye test.
4. The Cutaneous. (The cutaneous has been abandoned and will not be described.)

The SUBCUTANEOUS TUBERCULIN TEST. The subcutaneous tuberculin test is the official test for tuberculosis in all countries whenever transaction in cattle come under jurisdiction of governmental legislation. It continues also to be the method of testing most commonly employed by the general practitioner whenever he is called upon to detrmine the presence or the absence of tuberculosis in the dairy herds.

This test consists in the injection subcutaneously of one to four cubic centimeters of a 10 per cent solution of Koch's Old Tuberculin distributed by the Bureau of Animal Industry for official use is the equivalent and is the tuberculin most frequently used.

Before the test is made the cattle to be tested should be stabled and handled sufficient to render them free from nervousness and fright from the manipulations of the operator while taking the temperatures. Otherwise the test is often unreliable and unsatisfactory. On the day previous to the injection of tuberculin three or four temperatures about three hours apart are taken to ascertain whether the animals are carrying normal temperatures or not.

The test is to be applied only to those cattle having a normai temperature at the time of the test. Normal conditions as to feed, water, and care should be observed during the test.

Beginning with the eighth hour after the injection of the tuberculin the temperature is taken and recorded every two hours until at least the 18th hour has elapsed.

A positive reaction consists in a gradual rise in temperature over the preinjection normal temperature, a continued high temperature for a few hours, and then a gradual decline of the temperature to normal. This is the tuberculin curve and it is more important in the interpretation of the test than the simple rise of temperature. In a positive reaction the rise of temperature above the preinjection normal temperature varies from 1° or 1.5° to 4° or 5° F.

We should bear in mind, however, that while an elevation of temperature is the most prominent constitutional manifestation in this tets, it is not always present and at times it is not sufficiently marked to be of definite value. In connection with the test we should always take into consideration the other manifestations that make part of a tuberculin reaction, such as depression, anorexia, diarrhea, and local swelling at the point of injection. If the local swelling is considered a positive manifestation of a reaction it should persist for at least 24 hours after injection according to Dr. Traum, of University of California.

As to the accuracy of the subcutaneous test it is recognized that a positive reaction to this test is definite proof of the existence of tuberculosis in every case. The absence of a positive reaction, however, does not exclude the existence of the disease. Eber in searching all available statistics from 1890 to February 1st, 1892, found that 10.6% of tubercular animals failed to react. Lignieres states that from 7 to 8% of tuberculous animals fail to react to the subcutaneous test. Carini reported that in a herd of 361 now reactors 17.47% were found tuberculous. Malm gave as his estimate after a careful and accurate tuberculin test 2% of failures to recognize the disease. Jensen compiled the following data: of 468 tuberculous animals 90.8% reacted, 4.9% failed to react, and 4.3% gave doubtful reactions. Corbett and Griffith of the British Royal Commission infected artificially 130 animals with tuberculosis of which 11.5% failed to react to the subcutaneous test. We conclude from the above data that the subcutaneous tuberculin test fails to detect tuberculosis in from 2 to 17% of cases.

This test is unreliable when applied to animals carrying a febrile temperature. One application of the test renders the animal insensitive or immune to subsequent subcutaneous or intradermal tests for some time (30 to 60 days). It is not as desirable for calves as the intradermal test. Among other objections to the subcutaneous test there are, from the practitioner's standpoint (a) trouble involved in taking temperatures, (b) possibility of noting temperatures incorrectly, (c) difficulty of interpreting irregular tests (d) necessity of keeping the animals indoors, which is in itself sometimes sufficient to cause a rise of temperature, (e) the necessity of carrying out the test at certain hours at the risk of making serious errors. And from the owners of cattle the following objections prevail: (1) A reduction in the milk yield; (2) danger of specific mastitis and (3) danger of aggravating the general condition of the diseased animals.

II. The INTRADERMAL TEST: The intradermal test for tuberculosis is gradually becoming more popular and is giving satisfactory results in the hands of many veterinarians especially in some of the western states of our country. According to Haring of California this test consists in the injection of tuberculin into the deeper layers of the skin in $\frac{1}{20}$ to $\frac{1}{4}$ cubic centimeter amounts depending on the concentration of the tuberculin used. The official tuberculin distributed by the Bureau of Animal Industry may be used in doses of $\frac{1}{10}$ to $\frac{1}{5}$ cubic centimeter. Haring, however, recommends the use of alcoholic precipitated tuberculin made up into a solution of 5% strength in physiological salt solution and the administration of $\frac{1}{10}$ to $\frac{1}{5}$ cubic centimeter doses.

The most suitable place to make the injection is in one of the folds of the skin on the under side of the base of the tail at a point

on the fold about two and one-half or three inches down the tail from the anus. A hypodermic syringe with a short needle point should be used. Such a syringe should have a 25 or 26 gauge needle with a point 3/16th to 1/4th of an inch in length, similar to those used by dentist for injecting local anesthetics.

The subcaudal fold is grasped between the thumb and the first two fingers of the left hand and the needle inserted obliquely into the thickness of the skin grasped between the thumb and finger. The dose, if properly placed, can be felt in the layers of the skin as it is expelled from the syringe, where it remains as a small lump in the skin after the needle has been removed. It is a mistake to try to inject as near the surface of the skin as possible. It is difficult to inject into the layers of the epidermis and an injection into this part of the skin is of little diagnostic value. In case the needle is of the proper length (1/4th inch) there is little danger of going completely through the skin.

When the proper point in the subcaudal fold is selected it makes little difference whether the point of the needle is in the derma or in the subdermal connective tissue.

A positive intradermal reaction is indicated by a thickening of the subcaudal fold or by the appearance at the point of injection of a characteristic sensitive swelling varying in size from that of a small pea to that of an orange. The swelling may be either soft and edematous or hard and inflamed. The reaction is generally first distinct about the twelfth hour and continues to increase in size until the 48th hour. In testing infected herds new reactors continue to appear until the 70th hour following the injection. It has been observed that the early local reactions disappear in some instances before the 48th hour, while in one case a delayed reaction was noted which did not appear until the 90th hour. In order to be certain of every case, observations must be taken at least twice, preferably about the 36th and the 72d hours.

Small indurations at the point of inoculation about the size of the head of a parlor match frequently occur in normal non-reacting cattle, but anything larger than this which persists to the 72d hour should be considered a positive reaction.

In judging a local swelling, it is stated that the observer should depend more upon the shape, appearance, tenseness, sensitiveness and location with respect to the exact point of injection, than upon the actual measurements. Only experience can teach an operator how to be certain of a positive reaction when the local swelling is small. This is specially true when tuberculin containing glycerine has been used.

The intradermal test may be used under any condition for which the subcutaneous test is used. It is more suitable to the testing of range cattle and calves without regard to the temperature of

the animal at time of injection. It has the same effect upon subsequent intradermal or subcutaneous tests as has the subcutaneous test but to a lesser degree, i. e., it renders the animal insensitive or immune to such tests for a shorter time than does the subcutaneous test.

A definite positive reaction to the intradermal test is proof of the existence of tuberculosis, while a negative reaction with this as with the subcutaneous test does not exclude tuberculosis. There is not yet available sufficient data to permit us to draw definite comparisons as to the accuracy of this test with the subcutaneous. Moussu and Mantoux compared the intradermal and subcutaneous tests and concluded that the accuracy of the one equalled the accuracy of the other. Vallee, De Claire and Herbert tested 521 cattle by both methods. Four hundred ninety-four reacted to the intradermal and 506 reacted to the subcutaneous. Ward and Baker in 1910 and 1911 worked with 157 cattle, Longley and McKenna in 1912 and 1913 worked with 1,500 cattle and they concluded that the intradermal test equals the subcutaneous test in accuracy. Norgaard and Case after testing several thousand head, decided that the intradermal test was more satisfactory than the subcutaneous test. Martin in 1909 recommended the intradermal test for general practice. Hardin reported in 1914 that of 326 reactors 35 failed to react to the intradermal method and 44 failed to react to the subcutaneous. And also that of 291 cattle that reacted to the intradermal test only 282 reacted to the subcutaneous when subsequently applied. The intradermal test is unreliable when applied a few days after a subcutaneous injection but the time limits under which this holds true are not known.

The OPHTHALMIC TUBERCULIN TEST: This test is satisfactory only when the cattle can be kept tied or confined in stanchions under shelter for a period of at least 24 hours, except in the case of animals which show a reaction before that time. The cattle should be fed only on concentrates, or finely chopped hay to avoid the possibility of wiping off the exudate. The methods as recently reported by Traum, of University of California, consists in the following: By means of a one cubic centimeter glass syringe fitted with an ordinary needle from which the point has been removed, the tuberculin is thrown onto the eyeball. The eye is held closed, for a few seconds while the movement of the eyeball distributes the tuberculin over the conjunctiva. Concentrated tuberculin should be used, either 10% perified tuberculin, 5% precipitated tuberculin or 50% concentrated tuberculin. All are recommended. The ordinary tuberculin does not seem to give satisfactory results. Three to ten days later a second instillation is made in like manner.

Following the first instillation a reaction may appear between the 12th and 24th hour. After the second instillation the reac-

tions appear earlier, sometimes as early as 3 hours after the administration, but as a rule they appear between the 6th and 12th hours, in some cases, however, reactions do not appear until the 18th or 24th hour. These reactions may disappear rapidly or may persist for the entire period of observation, and sometimes are present 36 to 48 hours afterwards.

Observations on the first instillation should, if made, occur on the 9th, 12th, 18th and 24th hours. The second instillation not only brings out the reactions that have appeared after the first instillation, but also intensifies them and produces reactions in tuberculous cattle that fail to react to the first test. For that reason no observations are made after the first instillation of tuberculin.

A positive reaction consists in lachrymation, active congestion and edema of the conjunctiva, together with purulent or mocopurulent exudate collected at the inner canthus of the eye. Hutyra and Marek state that to be positive the reaction must consist of a purulent conjunctivitis (polynuclear leucocytus in turbid yellow exudate). According to the experience of the California workers the presence of a whitish, opaque, but more especially a yellow creamy exudate with profuse lachrymation designates a positive reaction.

As to the accuracy of the ophthalmic test various workers have determined different results. Haring states that of 139 cattle known to be reactors to the subcutaneous and intradermal methods when tested by the ophthalmic method pronounced reactions occurred in every case. In one instance a cow reacted to the ophthalmic test, but failed to react to either the intradermal or the subcutaneous tests. Opolka and Duering had 10% of negative reactions in 66 tuberculous cattle. Assman had only two failures in 212 cases. Both found that the test gave positive reactions in 505 cattle that had ceased to react to the subcutaneous test on account of previous applications of tuberculin.

A positive reaction to the ophthalmic test is definite proof of tuberculosis while a negative reaction does not exclude the existance of the disease.

The eye test is more reliable than either the intradermal or subcutaneous methods for testing animals that have been recently injected with tuberculin.

The test can be repeatedly applied without injury to the eye. Its frequently repetition does not injure its accuracy.

The ophthalmic test does not affect subsequent testing by any of the other methods and is not in turn affected by any previous testing. It is well adapted for use when other tests are not applicable. It is of especial value when applied in conjunction with

either of the other tests. It may be used before or after their application or given at the same time. The eye test may not only give unquestionable reactions when others fail, but in doubtful results with either the subcutaneous or intradermal tests it may aid us in reaching a decision.

Satisfactory results with this test cannot be expected when cattle with inflamed eyes are tested or when cattle cannot be observed as recommended, and are not protected during the greater part of the observation from strong wind or the drying effects of the sun. Most tubercular cattle will react to any of the tuberculin tests, some will react to only one or two of the tests while a very few will not react to any of the tests.

TUBERCULOSIS: ITS PREVALENCE, LESIONS AND INTERPRETATION OF TESTS.

V. A. Moore,

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Mr. Chairman and gentlemen: The prevalence of tuberculosis in this country, its great prevalence in certain places and its rather rare occurrence in others, I think can best be understood by tracing its history. Some year ago I had occasion to go through the agricultural literature and the veterinary literature in this country, including the reports of agricultural departments, of boards, etc., for the purpose of finding when bovine tuberculosis began to be considered in this country as a serious disease. The literature at my command was fairly good, I think. The university has a good library, and it has a good many of the agricultural publications from the beginning. I found but one reference back about 1820 to a condition referred to as tuberculosis and then one or two along early in the 60's, and not until about the time that Koch discovered the cause of tuberculosis is there very much in the literature of veterinary medicine in this country on that disease.

If you go at it from the other point of view and get the history of it from breeders, men who are old men now and who were twenty years ago, you will find that tuberculosis was brought into this country very largely through cattle and these were largely pure-bred that were imported into this country from infected areas, largely in England and Scotland and that the disease spread from those centers, and when these men came to understand and realize that their herds were infected with some bad disease, and most of these men knew what it was, they were sold. There were a good many auctions and these cattle were scattered. They would go perhaps into fifty different herds if fifty animals were sold, and a certain number developed into spreaders and eventually in-

fected these fifty herds, and then these herds were sold, or individuals from them were sold, so that in that way the disease spread to a large number of pure-bred herds in the country, and a great many people trying to build up their grade herds, introduced pure-bred sires and often pure-bred females, so the disease became very prevalent in a good many grade herds.

Then there was another condition that we must keep in mind that helped to spread this disease and that was the rapid growth of our cities and the necessity for a large milk supply the year round, and in order to meet that demand, a great many dairymen, in the East anyway, would sell their dry cows and buy fresh, and consequently tuberculous animals would go from one herd to another, and in that way infect a good many herds that otherwise might be free. So the two conditions of spread of the disease from those primary foci of infection, and the spread through the rapid exchange of dairy cattle in the dairy districts, existed. Then there was one other condition that has done a great deal to spread the disease, and that is in the establishing of creameries, where if there was one tuberculous herd in the community with open udder cases, it would infect the milk of the whole creamery, and these people would take back the separated milk to feed calves and in that way the disease was spread in a good many localities in the most alarming manner.

So we find today, after a lapse of perhaps thirty years, that tuberculosis has spread wherever these conditions obtained, and it is very prevalent in such localities. Where the dairy industry has not been large in certain sections of the East, in the foothills of the mountains, etc., where the farmers have not bought in many cattle and have not improved their herds very much, you find very little tuberculosis among them. But if you go into dairy districts, you are very likely to find it. The prevalence of it is dependent entirely upon these conditions.

There are certain ways by which tuberculosis is spread in a herd. One of the ways, and one that has not been emphasized, has been in the disregard of modern barn builders of sanitary principles. This era of barn construction has tended more than anything else to enhance the spread of disease. Hygienic methods are for the purpose of preventing disease rather than to minimize labor in the care of animals, but in the East they have built these large stables with the common feeding and watering troughs, and it is perfectly easy, if there was an infected animal or spreader in that particular row, for all of the animals to become infected. So we are finding one of the most important means of preventing it is to go back to the old methods to some extent and institute the principle of segregation. I think it must be done more than it is being done if people are going to get rid of this disease.

Here again, like in infectious abortion, our people have been more or less panicky, and they have jumped at methods, official methods based on opinions not well founded in fact, and as a consequence, we have a terrible mass of legislation in regard to tuberculosis and methods entirely foreign to the disease, which tend to prevent the control of it rather than to check the spread of it. A great many of the best intended methods of getting rid of tuberculosis have only tended to enhance its spread. For that reason, the time has come, I think, when we know enough about this disease so that these methods may be checked. You are dealing here, as with abortion, foot-and-mouth disease or any of these other scourges of cattle, with a specific disease due to a specific cause. That cause produces certain conditions in the body. That cause goes out of the body under certain conditions. It is spread under certain ways after it gets out, and it gets into the animals in other different ways. These ways are pretty different—there are extraneous methods by which the animals may become infected; but the great mass of animals become infected in one of two ways—either from the spreaders, through the pulmonary system, through the saliva getting in feeding mangers or watering troughs, or through tuberculous udders the calves become infected through the milk; and when we learn to take care of cattle in such a way that if there is a spreader among them, it cannot infect the others, we are going to get rid of the disease.

It is chronic along its development, insidious in its nature, and these things have to be taken into account and because some animals are susceptible and some are not. It is a thing you men know better than I, you who have been in practice, that certain families of cattle are very susceptible. You know that is true of the human species. Now and then there is a family that seems to be susceptible, and that is also true of cattle. We know that the methods for diagnosing the disease that we once thought to be very accurate and comprehensive are not so reliable in the negative cases as we thought; consequently, we have not any way, there is not any way by which you can positively pick out infected animals at once, and for that reason the control of this disease in my opinion rests absolutely in the hand of the practicing veterinarian. Law never controlled a natural phenomenon in the Lord's world. No legislation can prevent the spread of bacteria. They are going in the ways that God Almighty provided for them to go, and there is no law to prevent this.

Because some animals are resistant and some susceptible, you should have different conditions in different individuals and different conditions in different herds. Some animals valuable for breeding perhaps it is exceedingly important to conserve for that purpose. Some animals are not of high breeding value, only for beef, and the best way is to get the beef out of them as quickly

as you can. So there are these different conditions ,and no man can prescribe a formula to deal with this disease effectively in every herd.

There are certain fundamental principles in regard to the disease that must be observed and applied to the conditions that exist in the herd if we are going to get rid of the disease, and for that reason, I say that the control of this disease as with many others rests entirely in the hands of the veterinarian who is called by the owner when he has suspicions that he has the disease among his cattle, and it is this veterinarian who has to advise the owner what he must do in order to save the rest of his animals and what can be done to conserve the value of his herd without doing injury to his neighbor. All of the law necessary is the Golden Rule in controlling tuberculosis plus knowledge, good judgment and intelligence on the part of the veterinarian. When our veterinarians understand and know what tuberculosis is, the nature of the disease and how to check and prevent it and they have the professional knowledge which they must have in order to get rid of this so they can guide and influence the owners, this disease will disappear, and not until then can that be effected. So long as there are dickering, buying and selling of cattle and methods of control that at best are only partial, we are going to have this disease.

You all know about this as well as I do. There is nothing particularly new about it. It is just to understand it, to get an understanding of this thing, how it is spread and how to control it. There are dairymen who say you cannot raise a herd free from tuberculosis, and there are those who believe a herd that is badly infected, thirty or fifty per cent infected, cannot be cleaned up and a sound herd grown up. We know these things are not so. We know that herds can be assembled and kept free from the disease. We know that the tuberculous herds can be cleaned up and become sound and in a condition to produce sound calves. These things are matters of record and experience, and what has been done can be done again in that connection. What we have to do is to recognize that it is the sound herd that is the unit to deal with, not the animal that comes from the infected herd, not the animal that may be exposed, not the animal that may have resisted the disease and is immune. I doubt if any man has the knowledge by which he can tell the exact condition in these animals that have been exposed. It is exactly the same with foot-and-mouth disease and contagious pleuro-pneumonia, except in those cases you know from the effects, you know if an animal has been infected it will have the disease. In this case it may be a few years before you know, and consequently it has a chance to spread. It depends upon the opportunity the cattlemen give this germ to get in and spread, and the cattlemen are getting to be guided by their veterinarian. We have to come to be professional men and guide these people

and have to know as much about this disease as they do. That is a thing that veterinarians have been a little lax about. The owners of these animals have been greedy to get information, and they have read the bulletins published and have written thousands and thousands of letters about the disease. I receive ten letters from owners to one from veterinarians in regard to tuberculosis. That shows they are interested in it, financially interested in it, and consequently they are getting the information, and what we want is for veterinarians to know more about it than they do, so they can guide and direct them in this matter. When that time comes, tuberculosis will disappear just as Texas fever, malaria and other pests have done.

The next part of this program is in regard to the lesions. It seemed best to use some lantern slides for that purpose, but before I show these, I wish to show here in a brief way two slides in regard to the spread of tuberculosis. (LANTERN SLIDES.)

The most common means by which tuberculosis is spread in a herd, is due to healthy cattle coming in contact with the diseased animals. The tubercle bacteria escape with the saliva and the excreta.

We have not taken into account the importance of the infected animals, the importance of the carrier and perhaps the chronic case, and in tuberculosis the question of disinfection has been frequently neglected. A man with a tuberculous herd has sold it, and moved away and another man comes on the place with healthy cattle and puts them in the barn that has been saturated with tubercle bacteria from the preceding herd with disinfection, and one or more animals become infected and others become infected.

I do not feel that we can ever undertake to get at this disease without having an understanding of a portion of the work of two great men who have helped us to get at the bottom of the nature of infectious diseases, Pasteur and Robert Koch. Pasteur did little with tuberculosis itself, but he introduced into medicine the experimental method. He did more than any other to make clear what Lord Sidener and Hunter had said, that diseases were objects of natural history. He pointed out the cause of fermentation and introduced the specific element in connection with this disease. Koch, as you know, is the man who discovered the tubercle bacillus, and it is interesting in this case to know how it happened. Koch was working with tuberculosis, and although others had found things that they thought were the organisms of tuberculosis, the real thing had not been found. Koch left one of his assistants to stain a smear looking for the cause of tuberculosis. The boy went to a dance that night and forgot all about that specimen, and it stained all night. He went back in the morning very much perturbed about it because Koch was a little severe.

He fixed up the preparation and took it to Koch. Koch examined it and found the organism, and he questioned the boy as to how he had stained it, and he admitted that it had stained all night and he expected to get the reward for his negligence, but instead he was very highly praised and commended.

This shows the difference between the human and bovine forms. This is taken from Cruikshank. The top one is the human and the other is the bovine and this is the horse and this the bovine. Now, of course, horses in this country do not suffer from tuberculosis much, not because they are not susceptible at all, but because they have not the opportunity to become infected. In Denmark where they feed milk to the horses, they have a great deal of tuberculosis among them. Half of Prof. Bang's specimens in Copenhagen are of tuberculosis in horses.

This shows the germ in the human sputum, and it is interesting to see the phagocytosis. Any of you who have done any microscopic work in connection with tuberculosis in man or cattle in the secretion or excretion have frequently seen this phagocytosis taking place, and when you see that you can readily understand how it is possible that an animal that is somewhat resistant, when just a few of these organisms are taken into the tissues, they are taken up by these phagocytes and destroyed. It is here that the struggle for the survival of the fittest takes place. If the organism is able to develop in the cell, it will destroy the cell and develop tuberculosis. If it isn't, no infection happens, and we do not appreciate how many people and animals are affected with organisms, enough to cause disease in other individuals, that they have destroyed through the process of phagocytosis and possibly through the serum, but this is undoubtedly the most common way that the body has of combatting the disease in the beginning.

This fairly well illustrated the scheme of the tubercle, from the liver of the chicken. The first thing is the collection of a group of epithelioid cells, cells that look like the epithelioid type. If you will study the tissues of animals that are tuberculous, in cases of tuberculosis, you will find many and many tubercles that are so small that they are not seen with the naked eye. In the very beginning we have just a clump of epithelioid cells. The organisms are there and there is around that clump of cells a zone which we refer to as the reactionary zone of the lymphatic cells, that puts up a barrier between this focus of invasion and the surrounding tissue. Then the center dies and we get in the tubercle this zone. You do not find these zones this way in the bovine tuberculosis big enough to be seen with the naked eye, but with the microscope you will see them. The center is necrotic with giant cells surrounding it in which the organisms are more or less present and then the reaction surrounding that. That constitutes the wall in which the fibrous tissue develops to wall off a tubercle.

We must get the idea then that tuberculosis is a local disease in the beginning. If the germs are taken in through the throat, if they become lodged in the throat and pass through the mucous membrane and get into the lymphatic glands of the neck, you get these large glands after a while and they will discharge perhaps. They may also be taken in through the digestive tract. Feed a dog milk containing a lot of tubercle bacilli in a virulent form and kill the dog after three or four hours and make a series of sections of the intestines, lymphatic glands, etc., and you will find these organisms passing through and getting into the tissues. They get in there the same way as the food does. There is a great deal of lack of understanding why beef steak makes a man feel good. How does it get from the digestive tract? I say it is absorbed. These tubercle organisms pass through this membrane under these conditions and they get some somewhere into the tissue. If they get into the portal vien, they may go into the liver. If into the lymphatics, they go into the lymphatic glands. They may produce a lesion, or they may go up into the thoracic duct and get into the circulation and then be carried around in the body.

This is another section of the chicken's liver. I think the next slide or two shows the liver with the lesions in section, but here you see the necrotic center, this zone around and this reactionary zone here. After a while these get together. This undergoes necrosis, the wall breaks in and we have a tuberculous mass.

Here is a schematic thing of a tubercle in the lungs. We have talked about spreaders. The germ is located in here and it develops this tubercle. We get an infiltration here until these walls are practically all broken down, and it gets over here, gets into this air cell. Very soon this is going to work up here, and the individual is going to move that material up and the germs will escape. What happens in man happens in cattle, and until they do break out and get into these channels they cannot escape. You can see how they get generalized. The walls of that blood vessel are holding up as yet, but after a time they break down, and this material which contains a large number of bacilli will get into that blood vessel and it will get back to the heart and then will be pumped into the systemic circulation again.

Here is a lung showing the distribution following the injection into it of large numbers of the bacilli. Through filtration they get caught in the capillaries and there is where the tubercle starts. If you make sections of one of these you would get what I showed you in the liver of the chicken—the center, the zone of epithelioid and giant cells and the reacting zone. I have seen many cases in children of this kind. You see them in cattle once in a while. In cows I have seen two or three in the hundreds I have posted. I had one case of experimental tubercu-

losis where the lungs were just as full as that and I think more so, but you could not see the tubercles with the naked eye at all. On section, one could see with a hand glass, an ordinary hand lens magnifying four or five diameters, little gray nodules and you could hardly put a pin point in between them. The cow died. She had been tested, killed and examined microscopically. No one would have suspected her of tuberculosis because you could not see anything.

This is a chicken again, and I show it to point out these tubercles over the mesentery, where they start to grow out as these others until you finally get a wall of tissue around it.

Here is a chicken's liver showing tuberculosis. Many of these have been diagnosed as lympho-sarcoma, which is so common in chickens, but when you put it under the microscope there is no question at all but that a section of the liver there will show what the previous slides did of the structure of the tubercle.

I got that thing to show how absolutely thin a chicken can get and still live. It is a tuberculous chicken, and it looks as if you had taken all the meat from the breast bone. There is no muscle there, you can see that, and yet that chicken did not die of the disease. That chicken was killed. I guess it would have died before long.

This is a bit of the intestine of a cow showing an enormous enlargement of the mesentery gland. It is many times larger than it should be and simply built up of a mass of these reactionary zones, which in turn have become necrotic. These lesions usually take up the calcigerous cells and become calcareous. This is interesting again because of this fold here in the intestine. This is the serous membrane, but you can see it is porous there. This is an ulcer, but the tissue had not only eaten its way through the mucous mebrane but pores through the serous membrane.

Here is a case showing the ulcer that develop in a case such as we had, or where in the passing of the organism through the mucous membrane, it becomes lodged in that membrane. Now they develop this mass and the mucous membrane sloughs off because it undergoes necrosis and the contents escape and we get a tuberculous ulcer. My experience has been with this that as a rule the ulcers are longitudinal with the intestine. These little follicular lesions are at first round but probably would have merged together if the animal had lived. Three lesions are not common in cattle, at least have not been in by experience. It is only in the older cases. animals that die of the disease or are about to die of it that you find these. That is another thing in the study of tubercolosis, that different organs offer different degrees of resistance to various changes, so these ulcers are not common. You know that animals suffer from parasites—Oesophagostoma columbianum in sheep,

and there is another variety in cattle, and it is often called tuberculosis. If you will go back in the literature of tuberculosis in certain states fifteen or twenty years ago, you will find a great many cases of intestinal tuberculosis reported. I happened to be present at a meeting where one of these cases was reported and all he had was Oesophagostoma. I got some specimens and found the worm and sent him some slides showing the worm, and I have not heard anything about intestinal tuberculosis from that state since. It is easy to make the mistake unless you know. There is the same thing in chickens. There is a certain Taenia that burrows itself in and forms nodules and looks like tuberculosis.

I was in Massachusetts some years ago when they were trying to clean this tuberculosis up in that state. A man found these nodules in a sheep and the authorities ordered the sheep killed. The owner made a desperate fight against it, and they had an investigation made and found it was this parasite that caused the nodules. The ex-governor had all his fine chickens killed thinking they had tuberculosis when it was a matter of parasites. This mistake ought not to be made because I think we should have gotten past that state of our knowledge.

These are three cases showing three stages in development. I do not think there is a man in the room that would mistake tuberculosis there unless he had some reason to believe that the animal was tuberculous and couldn't find anything else. No one would question that or that. This particular animal from which this photograph was made gave a good reaction to tuberculin and was slaughtered, but we could not find any lesions except these little tufts of fibrous tissue with nothing to lead one to believe they were tubercles, but microscopic examination and Guinea pig inoculation proved that each of these was the beginning of the lesions.

This is a cross section of the liver showing the portal gland very badly diseased and showing this mass of tuberculosis eating into the liver. This is not particularly common, but it simply shows how much of the liver may be eaten up and still have the animal live. This animal was able to live and did not die. It simply shows how resistant animals are to it and how it is possible for a good part of such organs as the liver, the lung, the spleen to be destroyed and not prevent the animal from living.

Here is a part of the spleen. The organisms are scattered throughout the organ through the distribution of the bacilli through the circulation.

This is the diaphragm and a bit of the lung, showing tuberculous masses on the diaphragm causing the lung to adhere to it. Yost in Dresden has recently published an article on the origin of these tubercles on serous membrane, and it was his belief that these

lesions, these tubercles, developed as secondary lesions. He says probably there is an infection of something else and there is a little lesion there and that causes the tubercle to be arrested in its process through the circulation and to develop in these parts.

This shows a mass of this around the heart. The question of differentiation is between this and traumatic pericarditis. You have seen cases where the pericardium was filled with pus and sometimes it becomes caseated and quite firm, and if you are not careful you might mistake it for tuberculosis. I have several specimens of hearts of this kind when they were practically the only lesion found in the animal.

Here is the development of this mass on the pleura.

Here it is in the lung. The entire lung has become hard and calcified. The little tubercles have grown together.

Here is the lympth gland showing this, and there you see the thick capsule around it.

Here is an interesting specimen of tuberculosis on the skin, and I think very frequently veterinarians miss these lesions. They get a reaction but on post mortem they fail to find the lesion and draw the inference that there is a mistake, but as I have pointed out, these lesions may be so small that you cannot see them. This is a case that was killed after having reacted to tuberculin. I was present at the post mortem. When the animal was led to slaughter, I noticed just a little swelling in the leg just above the hoof. I thought it might be a bruise or something of that kind, but on post mortem we could not find a lesion of any kind, and then I looked into this swelling, and here with had a well developed tubercle. Here is a section containing tubercle bacilli. Guinea pigs were inoculated and developed it. Most of the cases are examined hastily, and the marrow of the bone is not examined and the spinal cord is not examined, and we have tuberculosis of these organs frequently enough to explain now and then a case of reaction.

This is a photograph of an udder. Here we get this same thing filled in with tubercles. Now, of course, these are the bad cases, the ones that spread the organisms. If there is one cow with an affected udder in a community, there will be germs enough in her milk to infect the milk of the creamery, so that it will be pretty generally distributed, provided the process is kept up. They won't all be infected the same day, but it is one of the serious conditions.

Here you get the lesion in the muscle of a pig. In swine the lesions are usually much more general than they are in cattle. I think it is because pigs are more susceptible. I do not think it is common to find muscular lesions in the pig, but occasionally you do.

That is all I had in regard to the lesion. I do not know that I have made it very clear, but I think you understand the general

structure of the typical lesion. The first lesion is where the organism is first lodged. It may be anywhere in the body. Usually in calves, if it is through the intestinal tract, more of them may be in the mesentery gland. When an individual is infected, the primary lesion, as stated, may be anywhere in the body, and from that lesion when it discharges into the circulation. the germs may be carried to any part of the body. It is worth your while if you have the opportunity to make a careful post mortem of cattle that have died of the disease and see the variety of lesions and the distribution of lesions, the old and new lesions, the large lesions and the small. I had one case that had five distinct groups of lesions. If you kill an animal after the tuberculin test and the disease has not gained any headway, you do not find it as a disease, only as an infection at some particular point. It might take years for that to develop into a good pathologic specimen. It takes time for the lesions to develop, and if you think of it, in any disease in which there are lesions which are at all chronic, there is a considerable time which elapses before death occurs. In diseases where they die quickly like hemorrhagic septicemia, you get practically no lesions except hemorrhages due to rupture of the capillaries.

Now in regard to the test. I wish to call attention to the limitation of these tests. When we get a positive reaction, I believe we are safe it is tuberculosis, but where we get a negative result, then you do not know whether they are infected or not, especially animals that are in a herd where open cases are liable to be, and for that reason I wish to call attention to one or two slides here.

Here is a chart showing the effect of cold water on the temperature of the animal. You all know cattle are very susceptible to environment, and by allowing a cow to drink all the cold water she wants if she is thirsty, you can hold the temperature down for quite a number of degrees for quite a little time.

This chart shows some temperatures that are rather significant. If you get a temperature going up sharply and quickly down, the chances are very very good that it is due to something else, that it is not due to the tuberculin reaction; but when you get a curve that passes the 103 mark and gives a curve, then the question is what is it? I think that the failure to properly interpret and act upon the interpretation of reaction of that kind has been responsible in many cases for the continuance of the disease in a herd and for the spread of the disease from one herd to another.

When the tuberculin first came out, the first herd was tested in Philadelphia and the second herd was in the soldiers' home in Washington. These herds were killed and bulletin No. 107 was written. It was pointed out there by Dr. Smith that in order to get an idea of the temperature it should be taken every hour before injection and 24 hours after injection. Practitioners and cattle

owners said, "We can't do that—it takes too long; it isn't practical and we can't do it. We have to have a temperature following injection just above the former temperature." For a time two degrees was necessary, that is the temperature after injection. In order to have this reaction considered positive, it must get two degrees above this point. If it did not, it was not considered a reaction. Some of the states modified that and said a degree and a half. We would leave a good many curves like this. After a time people began to think maybe they were allowing some animals to escape, and in some large herds the owners refused to have the animals condemned unless they complied with these legal requirements. It had to go two degrees or a degree and a half above the initial temperature. I made a post mortem of 17 animals where the temperature was below, and in every case in 11 of the 17 there were well developed tubercles, one generalized to such an extent it was condemned, and in the other six we did not find any lesions.

Dr. Paullos of Rotterdam has published some interesting data on this subject. He says if you get to 104, 90% is positive; between 104 and 103½, you get about 80%; between 103½ and 103, you will find at least 60% tubercular, and for that reason this curve is of the greatest importance in interpreting reaction.

Now in regard to the pre-injection temperature, twenty-four hours seems to be pretty long, and probably it is longer than is necessary. How many of you have taken the temperatures of normal cattle over 24 hours? If you have you will find the highest temperature is early in the morning and in the evening. Between the maximum and minimum it will vary in some cases one, two or three degrees. Now if you are going to compare pre and post temperatures, you must compare them about the same time in the day. This temperature goes up until we get to a point where reaction begins, and then it shoots up in this way and finally comes down. If you are going to compare temperatures and condemn, you must compare morning temperature with morning temperatures and evening temperature with evening temperatures; otherwise you are not fair to the cow. When you get reactions of this kind, and the normal animals go along here and the reactors all that way, there is no question about the interpretation. Those animals I believe are infected.

This cut is from Hutyra and Marek showing the ophthalmic recation. Of course, it follows Pirquet's work on the skin reaction and is looked upon as being of great importance. You get it in a great many cases, and you get it in a great many arrested cases. That seems to be so in the human species. You may have the tissues sensitized so you get reaction, and this reaction may last for a while. We do not know much yet about tuberculin reaction,

and we cannot interpret this reaction until we know something more about it. The latest theory is that it is sensitization, and that seems to be a good explanation, but why is it that the skin will react in this condition? I know a herd that was tested subcutaneously and failed to react. They were tested intradermally and nine of them reacted. In only one of these were we able to find lesions. Why is it that we got the reaction? Why it is that the skin becomes sensitized? We know that subcutaneously if you have local lesions, you will get a reaction. If you excise that part, you do not get a reaction. I don't know how long that will last. We are making some experiments along this line. We put some tubercle bacilli into the inguinal gland and when that began to swell a little, they reacted, and then after those glands were taken out, they did not react. We are keeping one or two that we have to see whether that will continue. Two or three of our animals that we thought were all right when they were tested later reacted, and when slaughtered, we found well developed lesions in other parts of the body. The sensitization seems in some cases to be in the tissues surrounding the lesions and in other cases it seems to affect the conjunctiva and the skin.

This is from the bulletin of Dr. Haring of California. Here is the needle used for injecting. It is very easy to run a needle through the skin of an animal, but it is not so easy to leave the point of that in the derm. If you get it into subcutaneous tissue, you get a rise of temperature exactly the same as with the subcutaneous test.

This shows the injection. It is considered to be the best in the skin at the root of the tail where there is no hair. Recently they have been injecting it into the eyelid, into the gland of the eyelid, but I do not see what difference it has from the other.

Here we get the lesions or swelling after the injection. In some states this is used as the official test and in others it is not. Some believe it is a better way than others. I do not know what I do believe about it. The reaction to tuberculin is a reaction to tuberculin, and I do not believe the reaction per se, the chemistry, the biology of reaction is any different in one place than another; only here in the skin we can get this swelling, and I can understand how in range cattle and in rather wild cattle, it is a quicker and perhaps easier way, and it may be just as good. I have not anything against it at all, but I do not see that it is superior in any way.

We will go back to the subcutaneous test. I referred to taking the temperature over a long time. The teaching that came from Smith's plan was that you should take them at least over 24 hours before injection. This was cut down until practitioners got to taking one or two per-injection temperatures and then taking three or four afterwards. By that method they detected a great

many reactors, but in the cleaning up process they left many reactors, so that the owners who thought their herds were cleaned up found afterwards they were not.

Where a reaction takes place a way out at this point, but where nothing at all occurred under the normal, usual time, the animal would have passed, but later it goes up and we get a good reaction. There was a man in Massachusetts, I think twenty years ago, who published a statement somewhere that we used too much tuberculin. He said if we used a little tuberculin and took the temperature over two or three days, we would get better results. Since this work has been done, I am wondering if we did not pass by that man's statement with not quite regard enough. In those animals where they had a great deal of trouble in getting rid of the disease and that they had been testing many times, they finally took the temperatures clear out here, and they found a few cases, which on post mortem were very bad. This means if we are going to be sure, we must take temperatures over a much longer time than is generally done. You will get a reaction in four or five hours once in a while. I do not know how to explain it, unless it is due to the degrees of the susceptibility of the animal.

Just a word in regard to the limitation of tuberculin. There has been a great deal of difficulty experienced, and I remember a case, which I guess is long enough ago so we can talk about it now. Some of you may know of the Biltmore herd in North Carolina, one of the finest herds in this country. They had a veterinarian there, who I think was perfectly honest and trying to do the best he could. He tested this herd and found no reactors. Finally he had physical cases, and he got Dr. Pearson, and he told me himself he never found more beautiful cases of tuberculosis. That veterinarian had pinned all of his faith on tuberculin. If you are going to render a service, you have to do your own thinking. In spite of the fact that that man had seen cases die of the disease, because they did not react, he thought it must be something else. Dr. Pearson got tuberculin from his own laboratory and practically all reacted, and the whole herd was lost. The reason for that was the defective tuberculin. The tuberculin is merely the protein of the tuberculosis bacteria, that is the bacterial protein of the tubercle, and then when you inject it, you get this anaphylactic reaction. If you do not have this liquid saturated with this growth, your tuberculin is not good, and consequently there is danger of failure in the use of tuberculin in that way. I do not think that danger is great at the present time. Our commercial houses are careful about it, and all state laboratories where they make it are very careful in regard to this point.

Then when it comes to injecting the tuberculin, a good many men are careless in the use of the syringe, and it is a habit in the East anyway, to inject in the evening, when it is not an impossible

thing nor as ridiculous as it sounds, to put the needle into the bottle of tuberculin and not have the needle into the fluid and inject a bubble of air instead of the tuberculin.

It is also possible to put the needle in the skin and push it out at another point and squirt the tuberculin on the floor. That is done sometimes, and some of these things will explain individual cases.

Again you may inject animals that are in the period of incubation. No lesions have occurred as yet, and you do not get any reactions, but the animal is infected, and in three months' time will react. Nobody is at fault. It is not the tuberculin's fault because no lesions are there.

Then we know in cases where lesions become walled off, they cease to react. I have demonstrated tuberculosis from arrested lesions in muscles of cattle that had not reacted for one or two years. Formerly they reacted, and going on the principle, once a reactor always a reactor, these animals were slaughtered and these lesions found. It is possible that if these animals had been tested six months or a year later, they would have reacted. Veterinarians have been condemned over and over again because these things have happened. It is not in the veterinarian's power and not in any man's power to determine these things, and what we have to do is to recognize the limitations of these tests, all of them, and not be too sure. That is why the veterinarian has to stand by the man and make reexaminations and retests in order to help him clear up his herd.

Bang says in regard to his method, and I feel I am justified in referring to the few days I spent with him, going around over the country to the herds he had under supervision and see the almost close affection that existed between the owners and Bang, as he was their adviser—he said that the benefit of his method was that when they got through and a herd was cleaned up, the owner knows enough about tuberculosis so that the herd does not get it again. When you go to make single injections, the owner does not have time to get this knowledge.

These men in Europe tried the sputum cup. They tried first tracheotomy, but people did not like that very well. Then they tried the esophagus, and by the use of this sputum cup, they can run it in the esophagus and scrape mucus off and in a depression in the tube they collect the mucus, which will contain tubercle bacilli in case the cow is coughing them up and swallowing them, as cattle do.

Now you can get open cases that do not react with tuberculin. We find spreaders in that way, and with bacteriological examination of the feces and milk, you can get at it in that way. All of these things have to be used. They are all valuable in these cases,

but there is not any one method that you can apply a single time to any one case and be sure that the results are positive.

Dr. Dimock: What I am going to say, I want you to understand I hesitate to say for fear you may think we want to show what we have here in competition. But we could go up to the museum and take out specimens and with two or three exceptions reproduce the specimens shown here. These specimens came from the veterinarians of this state and from the livestock of this state, so you should not think that these conditions exist only in New York. We can duplicate all of these lesions in this institution and they came from this state and not very far from this institution.

Dr. Bemis: We have left on the program the subject of mastitis, which is connected with this problem and with the abortion problem and is a subject of much importance.

Dr. Bergman will give us his paper on Therapeutics of Acute Mastitis.

Dr. Bergman: This subject of acute mastitis is not of my own choosing. I could have chosen other subjects that I would prefer to discuss. However, I do not believe that a subject could have been chosen which is of any more importance than the subject of mastitis and therapeutic applications. I do not intend to take up an exhaustive discussion of the treatment of mastitis but rather to discuss a few of the more rational therapeutic measures that seem to have proven beneficial.

THERAPEUTICS OF ACUTE MASTITIS.

H. D. Bergman, Ames, Iowa.

While the subject of this paper refers particularly to a discussion of such therapeutic measures as are indicated in assisting Nature to overcome the morbid processes accompanying certain forms of mastitis, it seems advisable to the writer to first mention a few general facts regarding mastitis before discussing therapeutic applications.

For a full century mastitis has been recognized as a serious disease of milk stock, but we have no record of its having been studied bacteriologically until about 1875, when Dierckerhoff presented his investigations. Hitherto, and since, veterinarians and stock men have sought a persistent cause in dietetic errors, defects in structure or ventilation of barns, incapacity of those doing the milking, and many other side issues, any of which may, and probably do, act as contributory causes. While it is probably possible that a very limited mastitis may result in cows from mechanical or thermal means, the generally accepted view today is that all cases of mastitis whether subacute, acute, or chronic, or of the sporadic

or rapidly spreading type, are due to infection with micro-organisms, and when a lowered tissue resistance results from any cause, the invading organisms are just so much unhampered in their attack. Various investigators have presented a multiplicity of views as to the most logical classification of the various forms of udder inflammation. While all of these views have some justification, apparently none equally satisfy both the practitioner and the laboratory worker. In practice it is difficult and often impossible to distinguish between an interstitial and parenchymatous mastitis unless seen very soon after symptoms are first noticed.

While catarrhal conditions in infection by the teat precede the involution of the deeper structures, and while resolution may take place in this early stage, it is difficult to specify except in an arbitrary way the period when the catarrhal merges into the parenchymatous or the latter into the interstitial. In an acute infection by the teat an entire quarter may be implicated in a few hours. It is not difficult however, in the early stages to determine between a catarrhal mastitis and a primary interstitial, also called phlegmonous or lymphogenous mastitis, that results from infection beginning on the surface of the udder or teats; later, however, there is no demarcation line between the simple interstitial and the mixed mastitis that may result. However, the disease is classified otherwise, the various forms may be typified according to the virulence of the attack and the terms subacute, acute and chronic applied, and in these terms lies the secret of the prognoisis.

The physiological activity of the udder in many respects favors the development of inflammation. The primary processes of lactation, particularly the congestive stage, closely resemble an acute inflammation. Inasmuch as the processes necessary for secretory activity favor the appearance of disturbances which readily assume an inflammatory character, it is natural that most cases of mastitis should occur soon after parturition. While occasionally cases of mastitis have been met with in dry cows, or even in virgin heifers, lactation is regarded as practically an essential condition of the udder. Gullebeau says that cows most frequently suffer from mastitis between the fifth and sixth years, and that two-thirds of the attacks occur very early after parturition, or in the first four months after the act. During the first stages of lactation the pressure downwards of secreted milk for sometime prior to milking, overcomes the teat sphincter to some extent, enabling the escape of milk and the ingress of germs; also at this stage the udder is in a state most easily injured by violence, and likewise is more liable to eruptive attacks, the lesions of which, particularly if upon the teats, are a more potent predisposing cause to mastitis than many serious injuries. Infection of the udder may occur by three paths: 1. By the teat canal; 2. By the skin; 3. By the blood or lymph.

Infection through the teat canal is the most common. Kitt, Nocard, Franck, Bang, and others have unfailingly produced the disease by the injection into the teat of pure cultures of various organisms, and even at times by merely painting the teat with the culture. Lesions of the skin of the udder, teat fissures, etc., are common, and are often the starting point of infection, producing primarily a sort of spreading lymphangitis which generally extends to the stroma and capsule of the gland. Infections of the udder by way of the blood or lymph are undobtedly rare, excepting possibly tubercular mastitis where the organisms may have reached the udder by this way.

Predisposing causes, whatever they may be, trauma, draughts, contact of udder with cold ground, chemical or thermal irritants, intestinal disturbances, chills, etc., which by vaso motor disturbances or otherwise, may weaken the defences of the gland are of great importance. Whether with the lowered tissue resistance certain organisms normally pre-existent in the udder assume a pathogenic character, or whether the presence of members of a specific group of organisms is essential to explain the infection is still a matter of uncertainty. Investigations seem to show that while varied organisms may be found in milk secreted from healthy udders, and are also to be found in the milk or interstitial exudates in cases of mastitis, only a few of these have been found to be specific.

In discussing the treatment of mastitis the writer has particularly in mind the sporadic subacute or more mildly acute type commonly met with in practice in this state, rather than the strictly acute or markedly infectious type which may run rapidly through a herd. It should be remembered that in all cases of mastitis there is a distinct relationship between the acuteness of the attack and the spread of the disease. Infection through the teat canal being by far the most common method of infection, the most common type of mastitis is primarily a catarrhal or parenchymatous mastitis, in which there is an exudation of blood serum, and an immigration of leucocytes into the acini and ducts of the gland, a shedding of the epithelium, and an inflammatory exudate into the interstitial and subcutaneous connective tissue. The local symptoms vary in intensity according to the case, in somewhat the following order: Swelling of one or more quarters, with curdled milk, possibly clots, rapid cessation of milk secretion, and frequently suppuration in the depths of the gland. In primary interstitial cases we find the lesions consist of a perimammary lymphangitis with considerable effusion between the skin and udder tissues, also some degree of exudation into, and thickening of the interstitial tissue of the gland; local swelling and tenderness is more marked; the swelling at first soft and doughy later becomes hard and firm, the skin is hot, red, or bluish red in color, and there is less alteration in the

milk than in primary parenchymatous. If the infection is not strictly acute systemic disturbances are not well marked in either case, the animal being slightly indisposed, temperature not over 104° F., probably ruminates, also eats and the amount of milk is not greatly reduced. A few hours later the pain and swelling may be considerably increased, and yellow serum containing clots may be drawn from the affected portion. With proper care, improvement may begin about the third day and recovery may be complete in a week, the quantity of milk secreted by the affected portions of the udder being somewhat lessened until after the next calving. Where quickly attended to, recovery is more rapid in interstitial, than in catarrhal or parenchymatous mastitis. It is seldom that a cow suffers from what may be termed primarily, either acute parenchymatous or interstitial mastitis without an extension of the process resulting in a mixed mastitis in a short time. An attack of markedly acute mastitis is somewhat bewildering in the rapidity of the developments both general and local. Almost invariably the general symptoms are the first to meet the eye, as constitutional disturbances are marked, the animal showing high temperature, loss of appetite, cessation of rumination, acceleration of breathing and circulation, constipation, and difficulty in walking. These general disturbances together with the rapidly morbid processes in the udder serve to differentiate between subacute and acute mastitis.

While numerous measures have been proposed for the treatment of mastitis, there is no recognized method of treatment that will certainly arrest the disease and restore the inflammed gland to normal. The degree of virulence of the infective agents, which fact determines the acuteness of the attack is the real factor that decides the success or failure of treatment. Prophylactic measures will not be discussed, however, these are of the greatest importance in all cases of mastitis, and particularly so in rapidly spreading acute mastitis, in fact in strictly acute or markedly infectious mastitis, the placing of animals under proper hygienic conditions constitutes the greatest factor in the control of the disease as frequently treatment of those affected is not very successful. However little avail medicinal treatment may be in strictly acute mastitis, it is of marked value in the subacute or mildly acute cases which are met with so frequently in practice in this state. An attempt will be made to outline rational therapeutic measures in these cases.

Mention already has been made of the inflammatory exudates into the acini, ducts, interstitial and subcutaneous tissue, shedding of epithelial cells, etc., as part of the pathological alterations in beginning mastitis. Early resolution and avoidance of complications depend upon an early removal of the exudates. If they can be removed and the epithelium regenerates resolution will

occur. If these exudates are not removed and the normal circulation restored, the inflammatory process in the interstitial tissue becomes productive and the udder becomes indurated, the newly formed tissue eventually contracting and producing atrophy. If the milk ducts are obstructed by clumps of casein or fibrin, and the pathological excretions cannot get out, abscesses will form. Finally if the circulation is cut off from a portion of the area of inflammation either by thrombosis, or pressure due to collections of pus or exudate, gangrene or necrosis will occur. The rapidly forming exudates in mastitis may be gotten rid of in two ways; that in the acini, ducts and cistern may be drawn off by milking, and hence in most cases the teats should be stripped every hour or two at first to remove exudates, milk clots, etc. Exudates in the interstitial tissues must be absorbed. Resorption cannot be inaugurated by artificial means, however, the natural processes may be stimulated and increased in capacity by therapeutic methods. The three factors to be looked to in assisting resorption are, the interchange of fluids between the blood and tissues, the leucocytes, and the quantity of blood flowing through the part. Purgatives, diuretics, and sialagogues increase the interchange of fluid between the blood and tissues. A full dose of Epsom salts in robust animals is beneficial, and often seems to lessen the force of the attack, or three ounce doses of Epsom or Glauber's salts together with two drams of potassium nitrate in water may be given every four hours. In all serious cases of mastitis digestion is interfered with, and constipation results. As constipation favors auto intoxication, the alimentary canal should be cleared as soon as possible. While the salines indicated above are quite generally used, the use of eserine and pilocarpine combined, administered subcutaneously which gives a quick action is quite desirable. Purgatives should not be repeated as they are weakening, but the derivative effect desired may be continued by the use of diuretics, potassium nitrate or acetate being preferred. Usually the fever present is reduced by the action of the purgatives, however, very high fever may indicate septic infection, and quinine, camphor, etc., are then indicated.

Whether or not inflammatory processes in the udder can be abated by general treatment is uncertain, however, drugs eliminated through the udder, such as potassium iodide one and one-half drams, boric acid six drams, salicylic acid four drams, urotropin two drams are often given. Any of the above drugs may be demonstrated in the milk at varying lengths of time when given to a healthy cow. Recently formalin (40 per cent formaldehyde), in one and one-half dram doses daily per orem, or one dram doses in four ounces of water intravenously have been recommended. In passing from general treatment it would hardly seem right not to mention phytolacca long used emperically as a specific

in mastitis. Inasmuch as this drug has some duiretic action, any favorable influences it may exert must be only in this way.

Inasmuch as leucocytes assist resorption by their phagocytic action, and cause the production of ferments which tend to disintegrate solid exudates, it is very desirable to increase the number of leucocytes if possible and also their phagocytic action. Rubifacients such as turpentine, spirit of camphor, a one to fifteen ointment of red iodide of mercury applied and allowed to remain for two hours, stimulating liniments, etc., applied to the udder will cause a leucocytosis, also hot applications, poultices, plasters, frequent milking, etc., which tend to cause an increased flow of blood through the udder. An increased flow of blood through the udder is very desirable and frequent milking subserves this purpose, as well as tends to remove exudate from the interior of the udder. The writer prefers hot fomentations and cataplasm applications at first, later prolonged gentle friction with a mildly stimulating anodyne combination of belladonna, camphor and alcohol. These with frequent strippings of the udder together with the general treatment previously outlined will at times modify an acute attack, or start reparative processes in subacute cases. A one to fifteen ointment application of red iodide of mercury left on for two hours, will often help start resorption, when acute pain and redness of skin have subsided, and the quarter has become somewhat indurated. The modern substitute for poultices, cataplasm of kaolin, is valuable spread hot over the affected quarters, covered with cotton, and a suspensory bandage tied over the patients back to support the weight of the udder. The cataplasm should be renewed every twelve hours. The practice of massage at the height of the inflammatory process is questionable, on account of danger of spreading the infection, as is also contraindicated when suppuration is present. The value of massage, or infriction with camphorated oil, lard, or weak oily liniments cannot be overestimated at the proper time, as they promote circulation in the inflamed organ. Circulatory stimulants will tend to cause an increased blood flow through the udder, caffeine being particularly indicated on account of its additional diuretic properties.

The question of irrigation of the udder with antiseptics in parenchymatous mastitis is still an open one. In the opinion of the writer even when so diluted as to render their antiseptic value doubtful, it seems there is a tendency to irritate the udder tissue, and actually increase the inflammation. Inasmuch as the germicidal power of milk is increased in mastitis it would seem that repeated milking would be less dangerous and of probably as much value as udder irrigation. Where irrigations are indicated or practiced a 4 per cent solution of boric acid, a 1 per cent solution of carbolic acid, or physiological salt solution at body temperature

may be used: The operation should not be repeated oftener than every other day. After the quarter has been filled, not too tightly, it is manipulated for one-half hour and then fluid withdrawn. Six to twelve ounces of fluid may be put into each quarter. While the exact disintegrating action of leucocytes upon solid inflammatory exudates cannot be brought about by drugs, yet a similar action may be obtained with both solutions of potassium iodide and sodium chloride. For this indication these two agents have been somewhat widely used in udder irrigations.

Inasmuch as bacterins have come to be so widely used and misused in practice, they might be mentioned in connection with mastitis. Favorable and unfavorable results are claimed which is not remarkable, inasmuch as the history of results in treating mastitis before bacterins came into use shows varying results. Since mastitis is generally considered a poly-bacterial disease, the preparation of an autogenous bacterin for each case would be quite difficult, hence a polyvalent bacterin would apparently be indicated and while this is somewhat of a hit or miss proposition, there is a possibility of considerable assistance in the relief of mastitis by the use of bacterins.

In this connection, Schmidt, the discoverer of the potassium iodide treatment for milk fever, recommends as a substitute for bacterins the infusion into the udder of equal parts of alcohol and glycerine, which will kill and disintegrate large numbers of the organisms concerned in the infection, and when these dissolved organisms are absorbed, specific opsonins will be produced to assist the leucocytes in ingesting the organisms still remaining. This mixture tends to destroy the epithelium of the udder and should not be used except in very severe cases. A milder treatment along the same line consists in diluting the mixture with an equal amount of physiological salt solution, injecting about 250 mils. into an infected quarter and leaving it is for three rays.

In connection with the discussion of bacterins might be mentioned so called lymph gland extract and leucocytic extracts which have been mentioned frequently of late as advantageous in certain types of disease, particularly those wherein proliferation of new tissue, and accumulations, with organization of cellular exudates are prominent factors. These extracts act differently than bacterins in that they are supposed to stimulate directly leucocytosis while bacterins increase the opsonic index thereby assisting the phagocytic action of the leucocytes rather than by increasing their number. Inasmuch as the leucocytes are very essential in the control of infections both in destroying invading organisms, and digesting as it were partially organized exudates by enzymatic action if lymph gland extracts do what they are claimed to do they are valuable. The writer has recently read an article by a prominent veterinarian in a dairy district, telling of marked success

in treating udder infections by the local use of hot fomentations and mild friction several times daily, laxatives, and 10 mils. of lymph gland extract (Archibald) subcutaneously every twenty-four hours, together with fluid extract of echinacea one ounce three times daily. Echinacea, it might be said is a drug stated by some investigators to be absolutely without therapeutic value, while by others it is given credit for opposing septic tendencies, stimulating glandular secretion and having a specific influence upon the lymphatic system. Echinacea is a widely used drug in practice, being praised by some and again condemned as useless by others. Its therapeutic value is based solely on clinical evidence, hence it is used empirically. The writer is neutral on the above line of treatment as he has had no experience with it. Possibly some of you are for or against it. Complications such as septic arthritis, or those in which surgical procedure is indicated are not a part of this paper, suffice to say that where abscesses point externally, or necrosis or gangrene supervene, that surgical procedure should not be delayed.

The prognosis of acute mastitis, whether primarily interstitial or parenchymatous should always be guarded. While there may be no danger of a fatal result, the value of the animal as a milk producer is in danger. The function of the udder may be arrested for an entire lactation period and there is always a tendency to a chronic condition of one or more quarters. Suppuration is a serious complication as it leads to destruction of large tracts of gland tissue. In attempting prognosis attention should be paid to the course of the disease; the longer it has existed the less the chance of complete recovery.

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Dr. Cotton: Mr. Chairman and gentlemen: I am in a very embarrassing position at this time, expecting me as a practitioner who makes his living by hard knocks and daily visits, to undertake opening the discussion following a scientific therapeutist who has read such a complete and exhaustive paper. To me it is

certainly embarrassing, and I cannot undertake to discuss it, but as the time is short I will simply undertake to give you a line of treatment that in my practice the last few years I have practically followed.

I agree with practically everything that Dr. Bergman has stated with perhaps a few minor exceptions. We are called to cases of mastitis, as he states, generally not in the incipient or early stages, but generally too late perhaps for the application of cold packs to do any good. However, I do think that at times where it is a question whether it is interstitial or parenchymatous and there is enough interstitial tissue affected so the skin becomes hard, tense and inflamed, I am satisfied that we do get benefit by cold applications for the first few hours. I tell the man to bathe the parts with cold water and after twenty-four hours, hot water, following this by frequent milking but no massage whatever during this acute period. I am in favor of astringents, perhaps white lotion diluted half, and I have been partial to spirits of camphor and alcohol in equal quantities. In some of the fancy herds, the owners will complain that we will decrease the milk flow by using camphor. That is what we want to do to get rid of this congestion. Then I agree with Dr. Bergman that we need absorbents, something in the irritating line.

But I have given up the idea of plastering with poultices. Put on your alcohol and camphor or astringent, then put a layer of wool on, then your cotton and bandage, and I think you will get a great deal more virtue out of it than you do out of your mud, and it is certainly cleaner.

Of course, in these acute conditions, I agree with Dr. Bergman that we want a quick purgative with watery stool. In these acute cases, we do have a temperature that subsist after the physic. I repeat the physic may be the second day and find that we still get a decreasing temperature. The internal treatment as he says may be camphor and quinine. Of course, at the present time, we do not use very much quinine, but camphor hypodermically suspended in sterile olive oil.

Most of these cases, particularly the catarrhal form, we do not often see unless they go quickly through a herd, as it is probably infectious. I remember one instance in particular in which the professor of animal husbandry at our university was consulted by a city man who had just started raising some fancy cattle in our suburbs and he told him he had a little garget in his herd and he said it was an infectious form. He was advised to take carbolic acid and inject all his cows. I had a fine case to contend with the next day. I have no faith nor any results with injections. I have faith in internal antiseptics. I have used urotropin or hexamthylenamin and have felt I got results. Perhaps I didn't but it was

from the local treatment. However, I am satisfied that we get results particularly in the chronic cases.

Dr. Bergman confined himself largely to the sub-acute type. When we have it in a herd of cattle, the majority of these cows do not have a complete resolution in all quarters, and in practically all of these cases we will find that chronic, old indurated quarter to contend with. If you are faithful and stay on the job, you will get results by giving intermittently iodide of potash in large doses, and there is virtue in the application of iodine. I take the iodine crystal, cut it with iodide of potash and suspend it in lard oil, and I am satisfied I get some results in these chronic cases and help to clean them up.

Dr. Way: Mr. Chairman and gentlemen: I am sure I have absolutely nothing to offer in addition to what Dr. Bergman and Dr. Cotton have said. They have covered the field so fully, and I am pleased to note that in the work we are endeavoring to do in five large certified herds, we are following out a course of treatment which is endorsed by these two men at least. I do not know whether we get good results from the use of methylene blue or not, but we have found in some cases methylene blue seemed to help relieve the trouble. I think if there is any benefit in methylene blue, it is probably indirect as it possibly causes a more alkaline and more soothing condition, if there is anything to it at all.

There is one little matter that I might mention. Some of the veterinarians in the East feel there is a certain relationship between the genital organs and the udder. Of course, this is true in the question of pregnancy and when an animal comes into milk. In a recent case of chronic mastitis in one of our herds—but before mentioning that I might say we have been expermenting a little in reference to the spaying of large producing cows and are endeavoring to learn how long these animals will milk profitably in the herd, with a view of possibly placing a large herd within the city limits of New York, and if the spaying of animals is profitable and they will continue milking after two or three years as reported, it is possible that they might stay in the herd longer than under normal conditions. In one case we had a cow that was suffering from chronic mastitis and was a chronic offender and could be detected by the use of the small strainer I described yesterday. She was giving a good flow of milk, and three or four days after the operation, the mastitis disappeared and she has not been affected since. I do not know whether there is anything in it or not. But the treatment of this disease is certainly very perplexing and the outline that has been given today is the best, and all and more than I could do.

Dr. Cotton: I forgot to bring up one point in the discussion. Dr. Bergman spoke of phytolacca and that he had no faith in it.

I am still sticking to phytolacca and I think in some instances it is beneficial.

QUESTION: May I ask Dr. Way if the ovaries were affected in the cow that they spayed?

DR. WAY: I cannot answer that because I did not do the operation, but the animal was not in calf, and I do not imagine that they were seriously affected because she had recently, that is within the last three months, passed through parturition. But I cannot say definitely. There may be something in this work which Dr. Moore referred to that they are doing at the college now in reference to the bacteriology of the ovaries and the oviducts, which will bring out some close relationship between these organs, which are apparently associated, at least, in a sympathetic way.

DR. STEWART: I was very much interested in this discussion because it applies to a disease process which has always given me considerable trouble. I was also interested in the statement that the therapeutics would be from somewhat of a rational standpoint. In the discussion concerning the matter, very little was said of the circulatory relation between the skin and the gland itself. Heretofore, as well as yesterday, considerable discussion was given to the gland, in which it was shown that the gland was suspended in a sac of yellow elastic tissue. The skin is very loosely attached to the gland, and the question is how we can consider it rational to rub something into the skin and have it affect a disease going on within this so heavily encased tissue. Should we consider that whatever was introduced into the skin would have to be taken into the general circulation and go back to the gland? I do not have reference to the infection which comes from the skin, but the disease within the gland.

DR. BERGMAN: I do not know that I understood all of Dr. Stewart's questions, but I do not remember of anything that I applied to the udder that was intended to penetrate and exert particular direct influence in that way. The favorable results in these cases are largely due to the counterirritation produced by these drugs applied locally. It is undoubtedly true, however, that such agents as mercury, iodine, etc., when applied with considerable massage do penetrate sufficiently to give some beneficial result.

DR. BEMIS: I want to say we appreciate your coming and staying with us even until six o'clock on the evening of the last day, and I am sure you appreciate and will express your appreciation of the work of these men who have come so far at so great a cost of time and energy to give us what they have given us these few days.

Dr. Griffith: I wish to move that a vote of thanks on behalf of those who have been present be extended to the college and to Dr. Moore, Dr. Cotton and Dr. Way. We certainly feel very grateful and we hope to come back here next year.

Dr. Bemis: All in favor of the motion signify by saying "aye." Contrary "no". The motion is carried. The conference is adjourned.

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